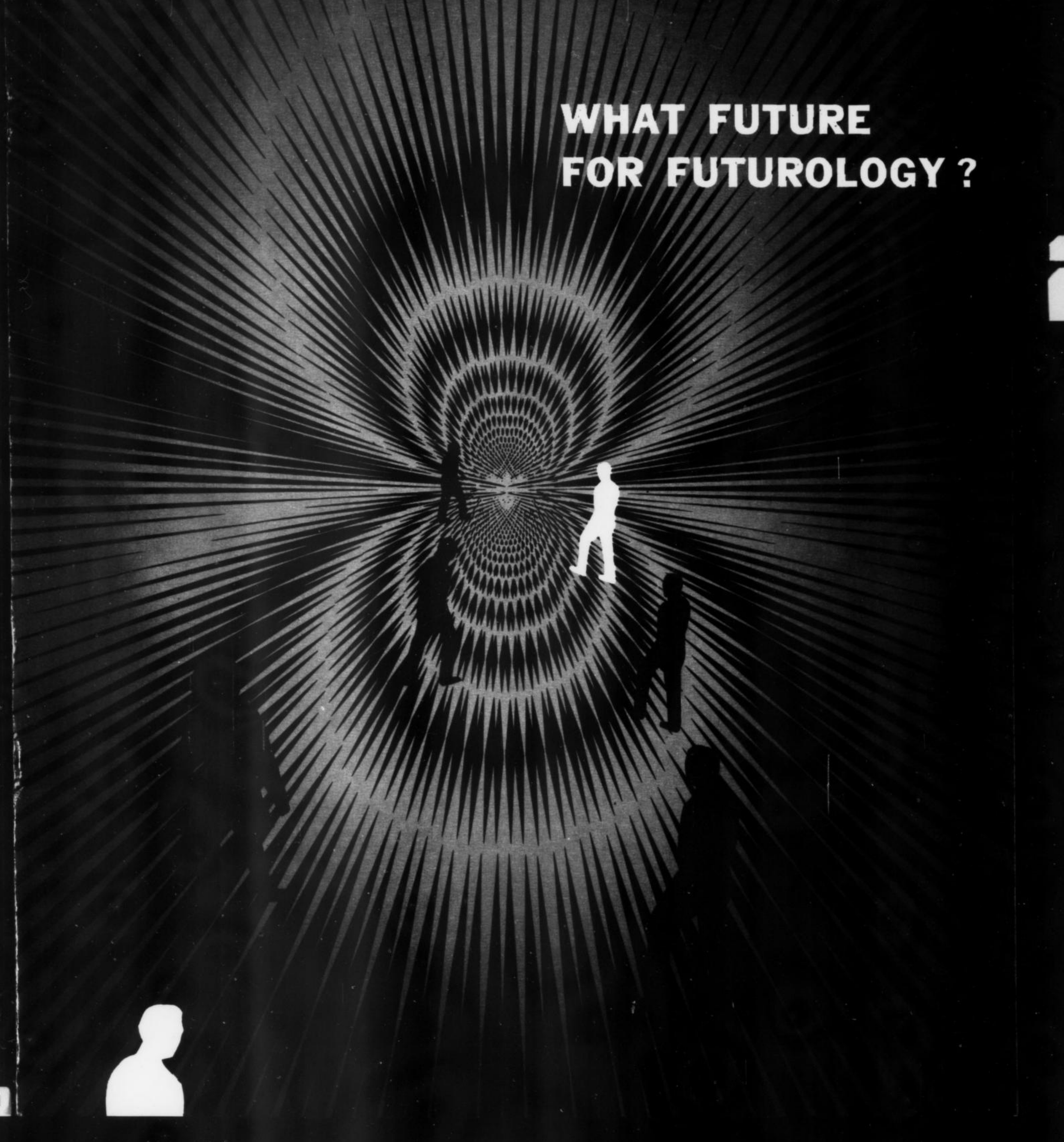
A window open on the world

The UNESCO Courier

April 1971 (24th year) - Price: 50 cents

WHAT FUTURE FOR FUTUROLOGY?



XUM

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Noble character

TREASURES OF WORLD ART

54 *China*

For over three thousand years, Chinese artists have found inspiration in transforming mere writing into graphic art. In China, calligraphy means more than simply beautiful writing; for the Chinese it is one of the highest forms of artistic expression. By the pressure of the brush and a delicate interplay of various types of movement and feeling the artist creates a world of sensitive beauty. The art of calligraphy has been practised on bone, stone, wood and bronze, and later on silk and paper and has evolved, not only with the materials used, but also with the evolution of thought. Right, two stanzas of a poem: "The moon, like a semi-circular disc of jade... slowly sinks below the horizon." It is shown here in the style of the great calligrapher Ho Shao-chi (1799-1873). Above, enlargement of the Chinese character "Chien", (meaning gradually) taken from the top of the left hand column, right. These illustrations are reproduced from the book "La Calligraphie Chinoise, un Art à Quatre Dimensions", by Leon Long-yien Chang, just published by "Le Club Français du Livre" (see Bookshelf page 33). Former President of the Chinese Academy of Arts and Crafts and Fellow of the International Institute of Arts and Letters, Switzerland, Leon L.Y. Chang is himself one of the great calligraphers of today.

The UNESCO Courier

APRIL 1971
24TH YEAR

PUBLISHED IN 13 EDITIONS

English	Japanese
French	Italian
Spanish	Hindi
Russian	Tamil
German	Hebrew
Arabic	Persian
U.S.A.	

Published monthly by UNESCO

The United Nations Educational, Scientific and Cultural Organization

Sales and Distribution Offices
Unesco, Place de Fontenoy, Paris-7e

Annual subscription (any edition) : $5.00
Single copies : 50 cents

The **UNESCO COURIER** is published monthly, except in August and September when it is bi-monthly (11 issues a year) in English, French, Spanish, Russian, German, Arabic, Japanese, Italian, Hindi, Tamil, Hebrew and Persian. Sales and distribution: UNESCO Publications Center, U. S. A., P. O. Box 433, New York, N. Y.,10016, MU 6-4707 (sole distributors of the U.S.A. edition).

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The Unesco Courier is indexed monthly in the Readers' Guide to Periodical Literature and in Current Contents - Education, Philadelphia.

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Nº 4 - 1971 MC 71-2-265 A

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Based on a drawing by E. Ragazzini
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Cover

As a method of forecasting the future and a guide for present-day planning, futurology offers enormous possibilities and vistas. But it is not surprising that its aims, methods and prospects have aroused so much discussion and controversy. "What future for futurology?". The answer, though positive, is not a simple one as this issue tries to show.

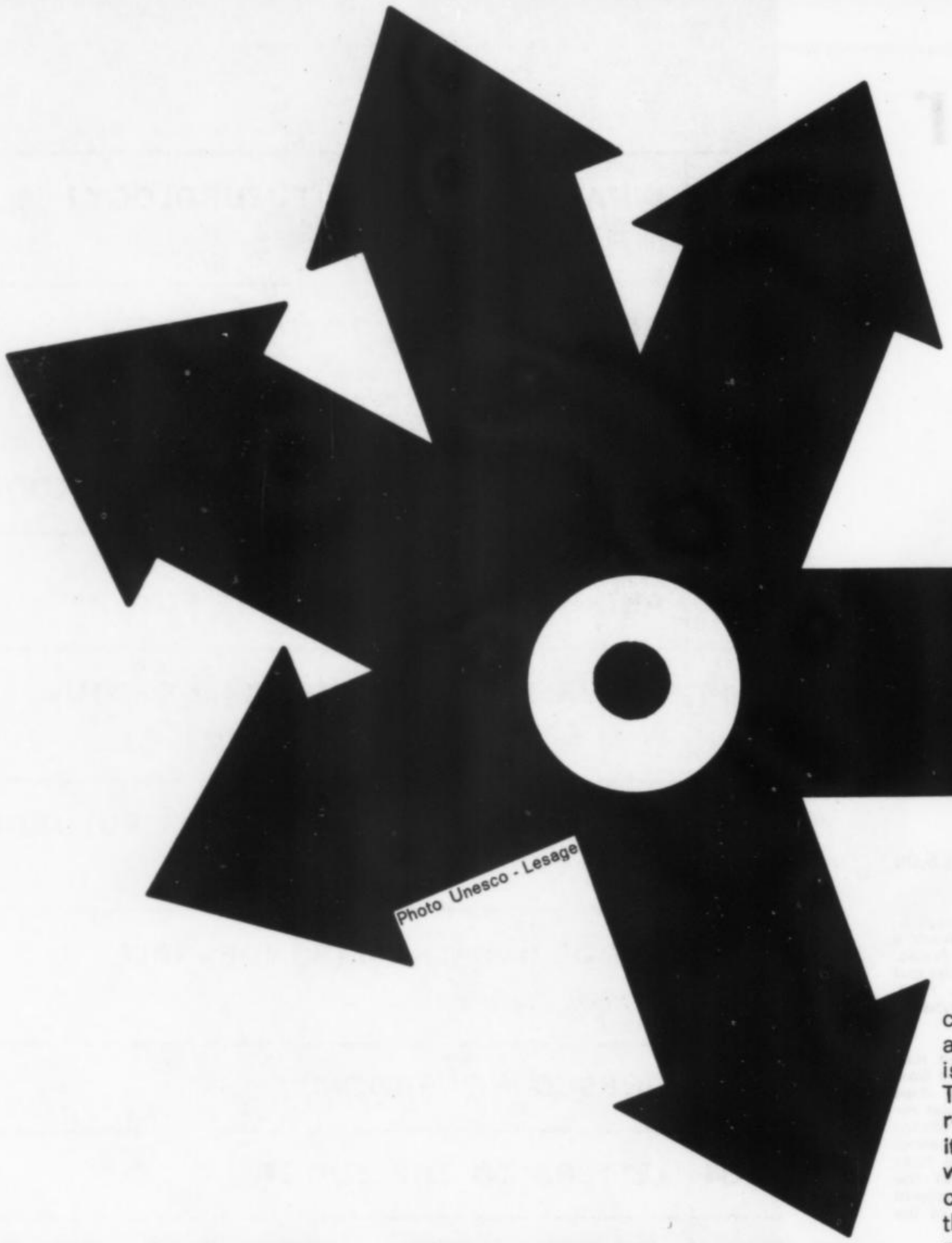

Photo Unesco - Lesage

The pros and

WHAT FUTURE FOR FUTUROLOGY ?

by François Le Lionnais

FRANÇOIS LE LIONNAIS, *French science consultant, mathematician and engineer, is president of the French Science Writers' Association. A member of the Advisory Committee on Scientific Language of the Academie des Sciences, in Paris, he is scientific adviser to the French Institute of Advanced Scientific Studies, the Institute of Cell Pathology, the French Radio and Television Network, and the French National Commission for Unesco. A former head of Unesco's Division of Teaching and Dissemination of Science, he is known as a speaker and writer on scientific matters, particularly of science popularization. Among his books on science are "Les Grands Courants de la Pensée Mathématique" (Main Trends in Mathematical Thought), Blanchard, Paris 1962; "La Science au XX^e Siècle" (Science in the 20th Century), Editions du Seuil, Paris 1951, and "Le Temps", Delpire, Paris, 1959, published in English as "Time", by Orion Press, New York, 1960. Mr. Le Lionnais acted as scientific consultant in the preparation of this issue.*

LIKE cybernetics and the computer, the population explosion and pollution of our planet, futurology is a topic everyone is talking about. The notion each of us forms of futurology, and especially what we expect it to be able to do, may well indicate whether our thinking still contains traces of a belief in magic, or whether, on the contrary, we are fully aware of the powers as well as the limitations of the methods of science.

On the one hand futurology acts as an irresistible fascination and allurement for all those who still cling to moth-eaten yet hard-to-kill superstitions and beliefs. On the other hand futurology invites us to cast off our superstitions and to replace them with less ambitious but far more reliable methods of solving specific problems.

Strictly speaking, there can be no such thing as forecasting if our reasonning and calculations are not applied in a clearly defined domain, that is if they do not operate in accordance with the natural laws of the universe. This is what the scientist refers to as scientific determinism which states that everything occurs in the universe according to natural laws and not as a result of pure chance; that every phenomenon has a cause, and that the same causes produce the same effect.

Nor can one speak of carrying out true forecasting if one does not have the required data and information, or if one does not know how the laws in a particular domain actually operate.

From this it is clear that the possibilities of futurology as a science are subject to three limitations:

First, if a problem studied by futurology deals only partially with predict-

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From somewhat haphazard beginnings, exploration of the future, or futurology, has become a world-wide research movement that reflects a broad range of scholarly and scientific interests and disciplines. Its practitioners offer their anticipations not as certainties, but merely as possibilities or, in some cases, probabilities. And such assessments are usually based on studies of technological and social trends and an imaginative speculation on the results of scientific and technological development. Yet even today, many of the realities of futurology are obscured by a lack of public understanding of its aims and methods. The U.S. futurologist Daniel Bell, chairman of the American Academy of Arts and Sciences' "Commission on the Year 2000," has pointed out that a good deal of today's public interest in the future arises from the bewitchment of technology. "What is bad," he writes, "is that a serious and necessary effort is in danger of being turned into a fad, and any fad trivializes a subject and quickly wears it out. A second evil is that many more expectations are aroused than can be fulfilled." To the question, "What future for futurology?," this issue of the "Unesco Courier" seeks to offer some answers that examine with equal impartiality the possibilities and the limitations of this new branch of human endeavour.

able events, that is, if the element of chance plays a certain part, it is self-evident that the reliability of any forecast will be proportional to the degree of chance or uncertainty involved.

Second, even assuming that chance plays absolutely no part in the question under examination, there is still no guarantee that the futurologist's prediction will be right. One has to make sure that all the relevant information and data—or at least the most important data—have been secured and taken into account.

Third, even if chance plays no part and all the relevant data have been secured, it is still not enough. The futurologist must also be familiar with the laws that govern the relationship between the various factors involved in the problem. While he need not necessarily know every single law he must at least know the most important ones and be sure that if any law is neglected it is only a secondary one.

If these three conditions are met, the futurologist will be able to make forecasts and predictions that are valid, for despite certain unknowns, they will have an excellent chance of coming true.

But can such severe limitations as the three indicated above all be met in a reliable manner? This is the real crux of the problem of the validity of futurology. I think one can say, however, that science has already given us the answer, and that answer is a definite "Yes," even if only in certain cases.

The classic example of this is certainly celestial mechanics. The Heavens do, in fact, offer us many testimonies of the achievements of "astronomical futurology" with predictions of the exact duration of each day of the year at every point on the globe, the movements of the tides, the eclipses of the sun and the moon, the movements of the stars and other heavenly bodies such as the comets (1).

But the Heavens are also a good example for reminding us not to lose sight of the important rules referred to above.

The movements of the planet Uranus can be predicted correctly only with a knowledge of the existence and characteristics of a more distant planet, namely, Neptune. The movements of the planet Mercury can be predicted properly and precisely only by replacing Newton's law of gravitation by the Einstein-Schwarzschild law of gravitation. Neptune was discovered by Leverrier when, in connexion with Uranus, he observed the difference between prediction and fact while trying not to call into question Newton's law of gravitation.

In the case of Mercury, it was, on the contrary, Newton's law which had to be called into question and replaced by a universal law in order to explain the difference between prediction and fact without having to postulate the existence of another planet. Beyond the solar system the predictions which one can make regarding stars other than the sun and concerning galaxies other than our Milky Way may be fruitful, but they are nonetheless at the mercy of the discovery of hitherto unknown phenomena; in recent years, astronomy has been rich in discoveries of this kind, among which may be mentioned radio sources, quasars, pulsars and neutron stars.

What we have just said in connexion with astronomy could and must be extended to the whole future of fundamental research in physics. Scientists have known, for several centuries, of the existence of gravitational forces, both electrical and magnetic (particularly in their earthly form, gravity) and they have succeeded in understanding their mechanisms sufficiently to be able to apply them in any number of ways.

Nuclear forces came to light at the end of the 19th century and other forces (curiously named, of weak interaction) in the middle of the 20th century. Before their discovery, who would have been able to forecast the appearance of these forces in the field of physics and on what evidence would such a prediction have been based? Moreover, how could anyone have predicted not merely the existence of these forces but the technical uses to which they could be put and the economic, social and political consequences of such uses?

A few years ago, scientists thought they had discovered a fifth force, different from the other four. This now lies in the graveyard of stillborn theories and hypotheses. But who can say that another "fifth force" will not see the light of day in the more or

CONTINUED NEXT PAGE

(1) *Halley's Comet is perhaps the most famous historical example. In 1682 the English astronomer, Edmund Halley, observed the comet and after calculating its orbit was able to predict its return with an accuracy that astounded his contemporaries. The comet did in fact return as he foretold at the beginning of 1759, seventeen years after Halley's death.*

The future of the past is in the future
The future of the present is in the past
The future of the future is in the present

less distant future? Not a single reliable futurologist would dare to make such an assertion. But should such a day arrive, mankind's whole enonomic, social, political and cultural future might perhaps be completely upset, as it is beginning to be by the use of nuclear forces.

In short, futurology must give up absolutely any pretensions at predictions as soon as it is a question of fundamental research aimed at crossing a frontier beyond which stretches completely unknown territory. One cannot, at the same time, know and not know. The illusion to the contrary comes (and we should not be led astray by the error of those who are victims of it) from the application of a philosophy, or intuition, or unscientific convictions, to a field which science regards as uncharted—whether temporarily or for all time—and which it is trying, or perhaps will try, to explore. Such intuitions and convictions may merit our respect, but any futurology worthy of the name should not take them into account.

IT is perhaps permissible to tone down the severity of this judgment when an enclave of scientific ignorance is surrounded on all sides by well charted territory. This is the case, for example, in biological research aimed at filling the gap separating our knowledge of living beings and of living cells from our knowledge of the biochemistry and biophysics of the molecules of which living matter is formed. It is permissible to suppose that this gap will be filled fairly soon. But here again, it should be carefully noted that:

- this is only a working hypothesis—it could be described as a "hopeful" hypothesis—because
- there is no guarantee that the apparently small distance still to be covered does not, in fact, conceal enormous difficulties, and consequently
- the estimate of the time needed is more of a guess than an accurate forecast.

If we move on from considerations of pure research to applied research and techniques, and then to their practical consequences, we come up against difficulties that are sometimes comparable, but which are also sometimes easier to overcome. In general, the more fundamental the discovery, the more profound and radical it is, the more it is abstract and the less its consequences are immediately foreseeable.

How could Apollonius of Perga and his contemporaries have imagined, in the third century B.C., that geometric study of the ellipse would enable Kepler, in the 17th century, to provide a model of the movements of the planets, a model which would be used to guide navigators at night and would transform the character of transatlantic trade in the following century? How could the British mathematician P.A. MacMahon have foreseen that an amusing arithmetical problem which fascinated him at the beginning of the 20th century—the study of the so-called Greco-Latin squares, that is to say, squares containing numbers arranged in a certain way—would provide agriculture with a means of increasing the production of cereals by having recourse to the laws of probability? (applying these laws intelligently to all the factors that determine the growth of crops—humidity, winds, rainfall, sunshine, the nature of soils, plant genetics, botany, the chemical make-up of fertilizers, etc.)

It would, of course, be easy to supply many more examples of this kind. But many others could equally be found which would show how intelligent and imaginative persons (often after having rid themselves of a paralyzing conformism) have been able to anticipate the use to which a discovery of pure science would be put.

This brings us now, somewhat abruptly perhaps, to the sector of human affairs where, if we discount elements of chance, the prospects of futurology are indeed enormous.

The obstacles to be overcome are admittedly very great but they are of a far less radical nature. The number of factors that must be taken into account is often discouragingly high, and many of these factors are very difficult to measure accurately. In addition they are difficult to measure fast enough to be able to forecast events... before they actually occur.

Furthermore, although in many cases we already know the economic, sociological and psychological laws that govern human behaviour, this knowledge is still quite primitive and can lead to monumental errors.

There is no shortage of historians to show (after the event of course) that it would have been possible to predict the French Revolution of 1789 (though not the taking of the Bastille on July 14), or the economic and financial crash of 1929 which began in the United States and then spread all over the world, or the student protests of May 1968. But supposing that, as Pascal wrote, if Cleopatra's nose had not been so long, the entire history of the world would have been changed, who, at that time (or even to-day) would have had at his disposal methods sophisticated enough to forecast what would have happened?

There is, finally, one other obstacle to the effectiveness of futurology in this field where it should theoretically be particularly effective. This is the fact, which weighs like original sin on all the human sciences, that it is carried out by men and is very largely concerned with human activities. The futurologist is both judge and jury. Even if he succeeds in eliminating any ulterior motives or bad faith, it is well nigh impossible for him to rid himself of the convictions, opinions and prejudices inculcated in him by his education, the social milieu from which he sprang or which he frequents, his experience and his reading, not all of which recessarily tend to foster his objectivity. These are so many garments of Nessus that he is hard put to leave in the cloakroom.

FOR proof of this, it is enough to read all the books and articles which have been written on the subject in the last twenty years. There is scarcely one that does not reveal in some way or other the political or religious ideas of its author, his nationality, or at least his adherence to a group of countries living under the same form of government or with the same ideology, what type of school or university education he had, in short, a certain view of the world which is very likely to colour his thinking.

In the natural sciences, it is virtually impossible to make such deductions about an author. It is true, the optimist can be distinguished from the pessimist, the timorous mind from the bold, but this has no repercussions on the objectivity of results obtained and is soon obliterated by the evidence of the facts.

Can a change in futurology which would immunize it from these imperfections be foreseen? Is it possible to forecast the future of a science and technique of the future? Provided that no time limit is set it seems reasonable to reply in the affirmative. For confirmation of this, we have only to note the studies made in the space of a few years by all those old branches of philosophy which now claim, and justifiably so, the title of the "Human Sciences" and which every day are approaching the status of "exact sciences".

It is only if we renounce all attempts at predicting discoveries ensuing from absolutely fundamental research, and only if we systematically ban all misrepresentations engendered by superstitions, passions or special interests, that the chrysalis will one day emerge as a beautiful butterfly. ■

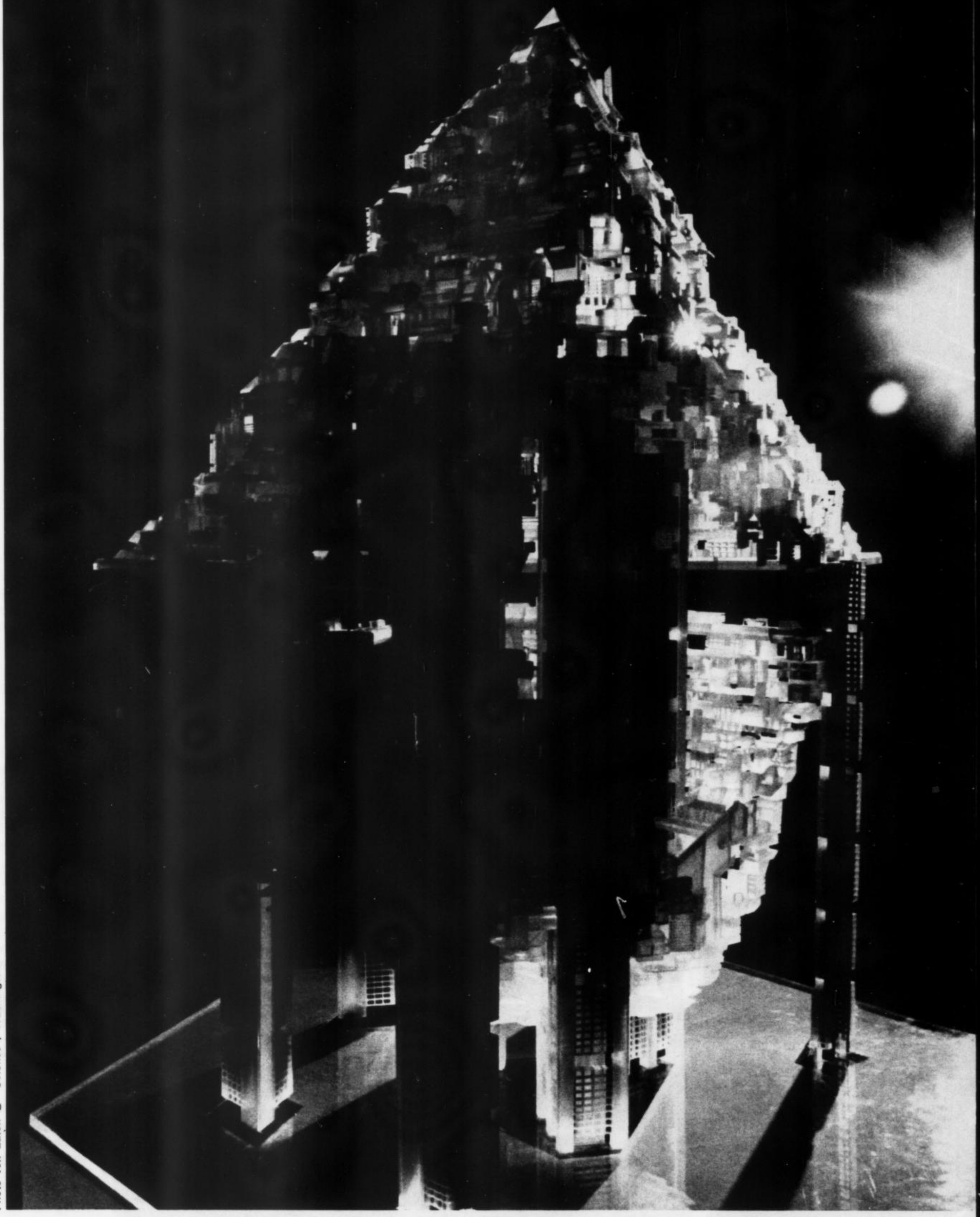

Photo Jon Eaton © "Science", Washington

ARCOLOGY — OR DIGGING UP THE FUTURE

The brainchild of American architect Paolo Soleri is this gleaming model of a town of the future. Like a double pyramid it would stand 3,500 feet (over half a mile) high and house 170,000 people. Utility inlets, sewers and elevators would be installed in the giant pillars. Each living unit would be about 22 feet high, 35 feet wide and 40 to 60 feet deep, and within it each individual would be free to design the sort of home he wanted. Soleri calls his style "arcology", a word coined from the marriage of architecture and ecology, since his aim is to compact rather than expand the city and leave most of the countryside for man's enjoyment. He believes the future will provide the new materials that would make his giant structures technologically feasible.

Photo © Upjohn Co., Kalamazoo, USA. Model designed by Will Burtin

The prospects for the biological manipulation of man are both exciting and frightening and the problem of responsibility for the uses of science may become acute in the field of genetics before the year 2000. Left, students from a New York high school walk through this model structure of a gene designed to promote better understanding of basic molecular, genetic and chemical aspects of life. The model represents a section of a chromosome (enlarged 300,000 times) at the stage when it duplicates itself in accordance with its hereditary code.

XUM

BREAKTHROUGH TO TOMORROW

by Robert Jungk

THERE has been a meteoric rise in the popularity of futurology among the public. But sudden, world-wide popularity of this kind is often based on over-simplification or misunderstanding of the facts, and this is true of futurology.

People expect so much from futurology. They seem to imagine that it can work scientific "miracles" and come up with infallible remedies for the crises that convulse the modern world. Seizing on futurology, popular imagination has raised some of the pioneer "futurists" to the rank of prophets—a role which most of them are loath to accept.

Predictably, the public's misconceptions about futurology have aroused far more expectations than can be fulfilled. Demands are made not only for clear-cut programmes covering the decades ahead, but also for precise techniques concerning the forecasting, control and direction of events that would enable man to forge his future, to stem, as it were, the course of history in the way he has dammed torrential rivers and harnessed them to his needs.

ROBERT JUNGK *is a leading figure in the field of futurology. He founded the Institute for Future Research in Vienna, was co-founder of the Association for the Study of Problems of the Future, in Hamburg, and is on the Board of the Future Research Centre in West Berlin. He is the author of several books on futurology including "Tomorrow is Already Here" (1953), "Brighter than a Thousand Suns" (1958), "Children of the Ashes" (1961) and "The Big Machine" (1969). With Johan Galtung he edited "Mankind 2000" (1969) based on the First International Future Research Conference, held in Oslo in 1967, and on the ideas and aims of a project called "Mankind 2000" which he initiated in 1964. Dr. Jungk at present teaches at the Technical University in West Berlin and at the Otto Suhr Institute of the Free University of West Berlin.*

It is hardly surprising that after so many decades of unrest people nowadays seek security and prefer certainties to surprises. And this attitude is even more understandable in view of the dangers that have arisen from the population explosion, famine, the destruction of the environment and the threat of war waged with nuclear, chemical or biological weapons.

But impatience and haste are unreliable counsellors; they lead people to expect too much, too soon. So one cannot rule out the possibility that futurology may one day be swamped by the stampede of those who are impatient to reach solid ground, and thus founder like a hastily built raft which capsizes through overloading.

Whoever is concerned with the future of research into the future is obliged to consider the possibility of a "shipwreck" of this kind now that opinion has swung from a premature craze for futurology to a no less premature condemnation.

Futurology is nowadays increasingly attacked by critics who point to errors in its forecasts and predictions. A recent example is the study by Keith Pavitt (of the Scientific Affairs Directorate of the Organization for Economic Co-operation and Development, in Paris) and Claude Mestre (French Ministry of Transport) which emphatically contests the reliability of several well-established methods of technological forecasting.

The report is so pessimistic that many persons on reading it might well conclude that "experimental long-term forecasting" has been an utter failure from start to finish, and should be abandoned without delay as a costly enterprise whose conclusions merely serve to mislead us.

But this would be a disastrous mistake. The systematic scrutiny and exploration of the future has become an imperative need in the present era of revolutionary changes in science and technology.

In the view of the French philosopher and educator, Gaston Berger, the need for a scientific and speculative concern with the future is a direct consequence of the unprecedented acceleration of change in the present age.

So long as changes were spread out over long periods of time, man could be compared to someone walking along a dark road. All he needed to make his way in reasonable safety were his eyes. Then came the comparatively faster tempo of the horse-drawn carriage, and torches or lanterns were needed to light the road for some distance ahead. When the speed of the automobile was reached, powerful headlights were required to prevent collisions.

Since Gaston Berger's death in 1960 (he was killed in a road accident) the pace has increased to the point where today's supersonic aircraft would be unable to operate safely without the help of complex electronic guidance systems.

So instead of disparaging or doing away with techniques that would help to smooth out our progress from the present to the future, we should endeavour to improve them. But we shall be unable to light the way ahead merely by boosting the power of our traditional "lamps". The development of techniques for forecasting the future will demand feats of ingenuity comparable with those that have carried us from automobile headlights to radar, and beyond that to the beams of lasers that now enable us to probe and

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explore greater distances than ever before.

Several thousands of specialists, working in almost every country of the world, are already developing techniques for lighting up—at short, medium and long-range distances—the road that lies ahead. This exploration is becoming a new dimension of our society and an indispensable condition for its survival and development.

In nearly every case, the work of these specialists relates to practical problems and projects. They advise governments, city authorities and industry. They are asked for forecasts on trends in population growth and the availability of food supplies. They are consulted on developments in technology, new materials, transport, production methods and trade. What they describe are "possible future trends" in fields ranging from world politics down to changes in the structure of the family, and from the exploration of outer space to the study of man's "inner space"—his mind or his spiritual nature.

Yet only a minute part of the intellectual and material resources devoted to futurology is used for a critical appraisal of the work it accomplishes or for a comparative study of its different methods with the aim of developing and improving them.

Thus far, almost no theoretical research has been done on futurology itself. New perspectives are revealed only as by-products of practical forecasting. This is one of the weaknesses of the new science of futurology. It scrutinizes the heavens and the earth, but looks at itself all too seldom.

The origins of modern futurology research go back to the latter part of World War II, when it was first taken up seriously as an auxiliary science to military strategy, on which it came to exert some influence.

The end of 1945 saw the launching of the Rand (abbreviation for Research and Development) project, comprising a working group of physicists and technologists and operating within a private aircraft construction company. From this group came the Rand Corporation, established in 1948 by the Ford Foundation and registered in the State of California as an independent non-profit-making enterprise.

In retrospect, the historical significance of this undertaking has become clear, not only through the work accomplished by Rand, but because it was a striking "social innovation". It was, in reality, the prototype of a new type of intellectual institution, the so-called "think factory", and as such it became the model for many similar establishments in government and industry.

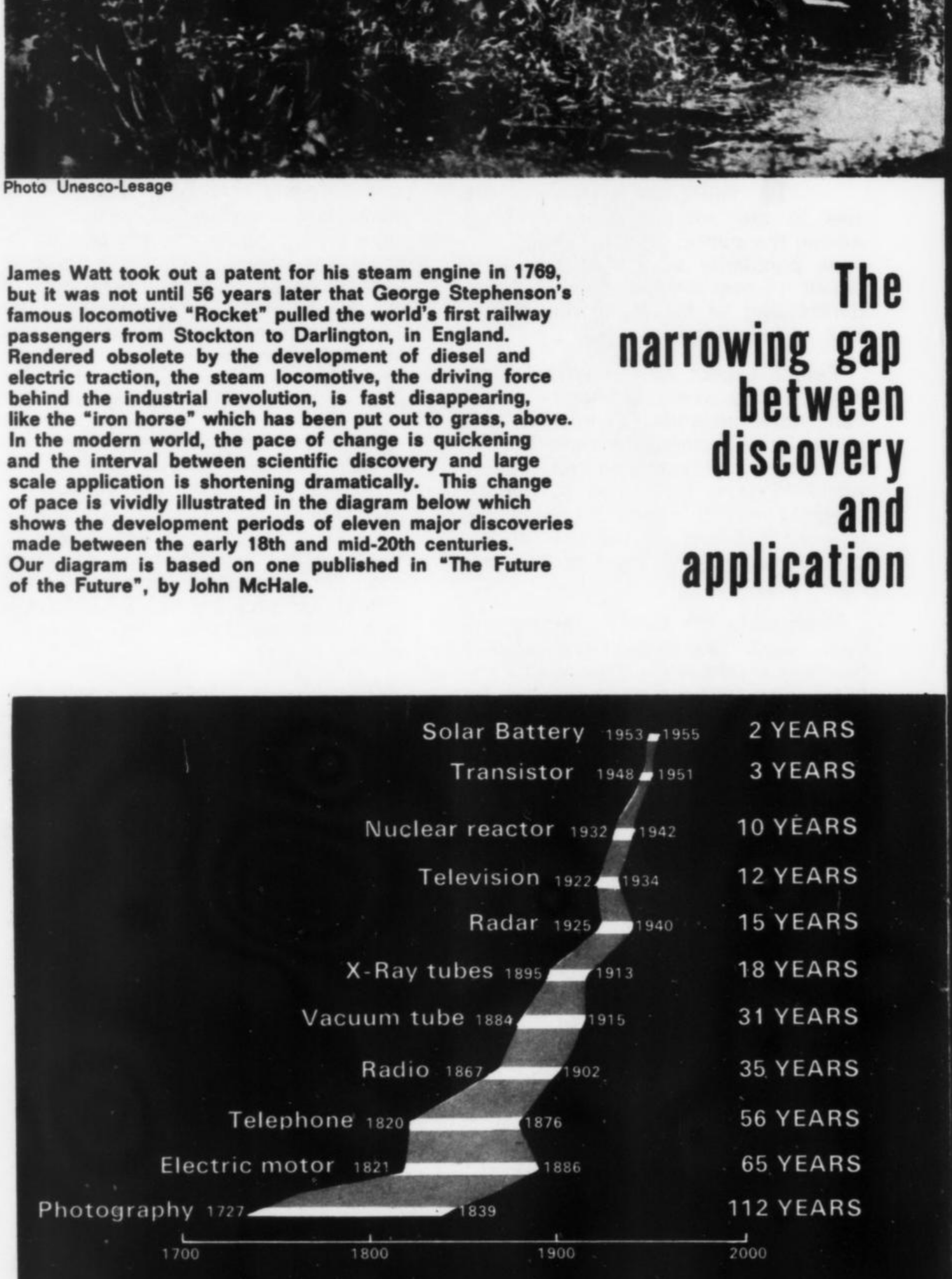
The most striking innovation in the "Think Factories", and their smaller

CONTINUED PAGE 12

Photo Unesco-Lesage

James Watt took out a patent for his steam engine in 1769, but it was not until 56 years later that George Stephenson's famous locomotive "Rocket" pulled the world's first railway passengers from Stockton to Darlington, in England. Rendered obsolete by the development of diesel and electric traction, the steam locomotive, the driving force behind the industrial revolution, is fast disappearing, like the "iron horse" which has been put out to grass, above. In the modern world, the pace of change is quickening and the interval between scientific discovery and large scale application is shortening dramatically. This change of pace is vividly illustrated in the diagram below which shows the development periods of eleven major discoveries made between the early 18th and mid-20th centuries. Our diagram is based on one published in "The Future of the Future", by John McHale.

The narrowing gap between discovery and application



Interval between scientific discoveries and their application

It took 112 years from the discovery of the principles of photography to develop its practical application, yet only two years to complete the same process with the solar battery. So fast is the pace of development nowadays that the practical results of basic research are upon us before we have had time to assess their desirability or consider their future implications. It is here that the futurologist, by extrapolation of trends, can give a breathing space in which to reflect. The first practical prototype laser was developed in 1960 by Dr T. H. Maiman; it is already being used in fields requiring great precision such as eye surgery, the control of machines, the machining of very hard materials, and ultra-accurate measurement. The use of lasers as communications channels, including inter-planetary communications, offers great promise. Below, part of the French designed reflector placed on the moon by the Soviet Luna 17 to bounce back beams emitted by an earth-based laser to enable scientists to measure the distance of the moon from the earth at a given moment with pinpoint accuracy.

Photo © Belzeaux, France

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Three-pronged shape of things to come

versions, the "Think Tanks," was their working methods. Whereas in universities, prior to 1950, one rarely found group work going on between the various science faculties, in the Rand Corporation interdisciplinary teams were quickly set up in which physicists and technicians were soon joined by mathematicians, geographers, historians, economists, sociologists, specialists in politics and finally, ethnologists and psychologists.

An outstanding feature of these working groups was the easy informality with which opinions were exchanged, criticism expressed and new hypotheses or concepts developed. Many researchers were attracted by this relaxed and intellectually stimulating atmosphere which contrasted favourably in many ways with the more formal and monotonous character of university life.

Most of the methods used in systematic forecasting which were accepted in the 1950s and 1960s, but which today are targets of growing criticism, were first developed in the American "Analytic Institutes" (a title they themselves prefer to the journalistic tag "Think Factories"). Among these institutes are the Rand Corporation (already mentioned), IDA (Institute for Defense Analysis), RAC (Research Analysis Corporation), SDC (Systems Development Corporation), ANSER (Analytic Services) and SRI (Stanford Research Institute).

The hundred or so methods by which they seek to grasp the shape of things to come can be considered under three main headings:

- Intuitive forecasting
- Exploratory forecasting
- Normative forecasting.

Intuitive forecasting combines expertise with imagination and insight. The best known techniques it has developed thus far are "Brainstorming" and, above all, the "Delphi technique".

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'THINK TANKS' AND 'WORKSHOPS

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Imagination plays a special part in the exploration of the future. It is the only force capable of bursting the bonds of the "prison of time" in which we are all incarcerated. We are all, even geniuses in the Einstein class, much more marked by the spirit and style of our age than we are willing to admit, and this influences our vision of future developments.

Max Iklé, the Swiss-born American futurologist, has given a very apt illustration of how forecasting is conditioned by the time context in which it takes place. Taking the example of medieval man, he tried to imagine how he might have envisaged the future. Very probably he saw it as an age in which church, cloister and clergy would play an important part—in fact a kind of Middle Ages writ large.

Looking back we now know that such a surmise as to the nature of modern times would have been not only very incomplete, but also partly mistaken. Yet surely we are following the same line of thought when, to take the most frequent example, we imagine the twenty-first century as a period of still deeper probes into the exploration of the world and nature, and of still more powerful and precise technological development.

If futurology is to learn from the mistakes made by prophets of the past, it must do more than merely prolong current trends or extrapolate curves. It must also attempt to extend its thinking to take in that which has never been seen, the unheard-of and the wholly or virtually inconceivable. Yet here it comes up against a paradox. For if we knew what we cannot yet know, this would fall within existing knowledge; hence it could not be part of "things to come" in the strict sense of the term.

There is however a broad area of the future where that which is no longer Today, and which is not yet Tomorrow, can exist in the form of hypothesis, conjecture, or speculation. Only a very few of the many ideas which spring from this intermediate area later become a reality. Most of them are short-lived; some of them, premature anticipations of the future, are allowed to "hibernate," while others begin in intellectual forms totally different from their subsequent practical application. This is the area of the future to which futurology should pay particular attention. Futurology should not merely assume the role of observer, but should also provide an incentive and a stimulus.

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Futurology has introduced some innovations here, such as the "encircling curve", which attempts to draw a circle round the extreme possibilities of a technical system—the maximum possible utilization of the power of a nuclear accelerator, the most rapid methods of transport, the brightest possible light, and so on. Account is taken of so-called "internal" limits set by nature and "external" limits such as those related to population growth, the national product, or the surface of the globe.

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In exploratory forecasting a special place is occupied by the "morphological method" of the Swiss astrophysicist Fritz Zwicky. The steps consist of stating the problem precisely, exposing the important parameters, revealing the dimension, range, and number of values for each parameter, determining the number and kind of solutions, and finally evaluating and choosing the preferred solution.

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People tend to think that science is centered on what has already been formed, described, or has already taken place, or on what can be accurately observed or measured. But this involves setting up far too rigid a system of checks. Discoveries in recent decades, from X-rays to psychoanalysis, from the irruption of assymmetry into mathematics to the assault on the principle of the conservation of parity in nuclear physics, have shown time and again that standard, accepted opinions are often no longer capable of correctly apprehending reality because they are based on too rigid and dogmatic a conception of what reality is.

By reinstating imagination, and by associating it with research which can be tested and evaluated, it is possible for futurology to open up and enlarge the way in which the scientist works and give him greater flexibility. And since it lies halfway between the two cultures of art and science, it can overcome prejudices and obstacles on both sides.

In "Think Tanks" or "Workshops of the Future" much fruitful collaboration has already been developed between sculptors and engineers, painters and computer experts, poets and naturalists, linguists and sociologists, novelists and political scientists.

The forms assumed by these joint attempts to discern and shape things to come are highly varied. In a "brainstorming" session participants temporarily suspend their critical sense and give free rein to the creative interplay of their imagination. An attempt can be made to discover the future course of events by writing a political scenario. Simulation or gaming techniques are used to produce an idea of future town planning and communication problems, after which complete community systems are constructed.

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Taken from one of a series of talks broadcast by the International University of the Air.

Three-pronged shape of things to come

versions, the "Think Tanks," was their working methods. Whereas in universities, prior to 1950, one rarely found group work going on between the various science faculties, in the Rand Corporation interdisciplinary teams were quickly set up in which physicists and technicians were soon joined by mathematicians, geographers, historians, economists, sociologists, specialists in politics and finally, ethnologists and psychologists.

An outstanding feature of these working groups was the easy informality with which opinions were exchanged, criticism expressed and new hypotheses or concepts developed. Many researchers were attracted by this relaxed and intellectually stimulating atmosphere which contrasted favourably in many ways with the more formal and monotonous character of university life.

Most of the methods used in systematic forecasting which were accepted in the 1950s and 1960s, but which today are targets of growing criticism, were first developed in the American "Analytic Institutes" (a title they themselves prefer to the journalistic tag "Think Factories"). Among these institutes are the Rand Corporation (already mentioned), IDA (Institute for Defense Analysis), RAC (Research Analysis Corporation), SDC (Systems Development Corporation), ANSER (Analytic Services) and SRI (Stanford Research Institute).

The hundred or so methods by which they seek to grasp the shape of things to come can be considered under three main headings:

- Intuitive forecasting
- Exploratory forecasting
- Normative forecasting.

Intuitive forecasting combines expertise with imagination and insight. The best known techniques it has developed thus far are "Brainstorming" and, above all, the "Delphi technique".

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The world we want tomorrow

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More detailed studies are now being made of the interactions between numerous recent developments in technology. A typical example is the investigation of possible effects of the further development of means of communication (telephone, television, "picturephone", computer links to every home, and so on). The possible psychological development and the new aspirations and values of future generations are questions that have still to be explored.

Such are the kind of images of the future that exploratory forecasting seeks to project, taking into account many different factors which are difficult to determine since they are far more varied and contradictory than they were even a few years ago.

Normative forecasting, another group of methods, is now coming to the fore. Here advantage is taken of a criticism which has always been levelled at attempts to forecast the future. It is argued that intrinsic in any forecast is either the incitement to act in its favour or a counter-reaction against it. In other words, since a forecast is heard by men ready to act, it carries within it the seeds either of its destruction or its realization. In a system of exploring the future which does not claim to be an "objective" science, but a "science of action", such criticism is not contested; on the contrary, it is admitted and exploited in a positive way.

The trend at the present time is consciously to shape the future by drawing up standards and objectives. The viewpoint of Olaf Helmer, a U.S. futurologist, who with his associates at the Rand Corporation developed the Delphi method of forecasting, based on the polling of a series of expert panels, is characteristic of this new attitude to moulding the future.

"The fatalistic concept of an unforeseeable and unavoidable future", he states, "is being progressively abandoned. We are beginning to realize that there are a great number of possible futures, and that appropriate action can influence these possibilities in different ways. This raises the exploration of things to come and the attempts to influence them into realms of great social responsibility. If we wish to assume this responsibility we must cease to be onlookers at the spectacle of the world's history, and must influence history with the intention of shaping the future."

FUTUROLOGY AND THE SEARCH FOR PEACE

THE major aim of futurology can be to safeguard peace. It could even be said that the possibility of the world destroying itself has provided the most powerful impetus to the development of this new form of research. By warning us of the crises and catastrophes that threaten it aims to prevent them or to lessen their effects.

But can futurology really be effective in this field? By means of exploratory forecasting it can explain dangerous trends to politicians and the public. Anyone, for instance, who examines the comparative trends in population growth and in discoveries of new sources of food over the next twenty years will have no difficulty in deducing that between 1975 and 1982 some serious crises will arise that will inevitably affect world politics.

Other forecasts, for example those which point to the unequal growth in average national income in the highly industrialized and the developing areas (a twenty to one ratio), indicate a further increase in the inequality that already exists between the "North" and the "South" of our planet.

If we add to this the forecast that towards the end of the 1980s the population of the developing countries under the age of 15 will equal the entire population of the industrialized countries, then the warning signal is plain for all to see.

The warning role played by futurology should not be underestimated. It has an increasing effect upon politics, but, paradoxically, is likely to harm its own reputation with the public. The latter might indeed be inclined to scoff if the catastrophes predicted by the "pessimists" fail to materialize. Not everyone will want to admit that disasters were avoided precisely because futurology's "radar" picked them up in time.

Futurology can play another, and in the long run perhaps more important, part in the search for peace: it can draw up the requirements for future peace on a broad basis and in great detail. Work along these lines includes not only the studies on "models for world order" undertaken in the U.S.S.R., India, Japan, Uganda, Chile and the Fed. Rep. of Germany, but also the many studies of the Pugwash movement, founded by Albert Einstein and Bertrand Russell, which seek to develop a host of ideas for future peaceful co-operation between different peoples and ideologies.

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AN example of this kind of normative behaviour was the American project for a manned lunar landing. Years before the scientific and technical capability for a successful flight was sufficiently developed, a project was begun and its execution "forecast" for a specific date. A target was set, and "future history was made".

Normative forecasting has developed methods for weighing all possible objectives against each other as impartially as possible, and for establishing priorities. Its range includes modern theories on decision-making. A series of methods has been devised which, using a kind of reverse-planning technique, starts from the future objective and works back to the present; the necessary intermediate stages are thus determined and an attempt made to plot the best possible course between Tomorrow and Today.

The "Relevance Tree" method has proved to be particularly satisfactory. Starting from the fixed objective, the top of the tree, and working downwards, alternative approaches are assessed and weighed against each other. Originally developed in the military field, this method has signally proved its worth elsewhere, for example in the evolution of biology and

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Photo R. Dix © Hanns Reich Verlag, Munich

medicine. It highlights for decision makers what decisions they should take and when, and what finance they should inject into specific projects.

Simulation techniques occupy a special place among normative methods. An attempt is made to envisage possible conflicts and possible future developments which have been overlooked.

Recently, a new trend in futurology has gained ground in every country. It makes men and women of every race and from every sector of the social system the focal point of its activities, and seeks to explore a broad range of their hopes and aspirations —biological, psychological, political and social.

Throughout Europe, futurologists such as Bertrand de Jouvenel (France), Dennis Gabor (U.K.), Ugo Spirito (Italy), Johan Galtung (Norway), A. Sörensen (Denmark), Fred L. Polak (Netherlands), Ossip K. Flechtheim (Fed. Rep. of Germany), Igor Bestuzhev-Lada (U.S.S.R.), Radovan Richta (Czechoslovakia), A. Apostel (Romania), Andrzen Sicinski (Poland), Edeling (German Democratic Republic), to name but a few of these specialists, are turning from technological forecasting and scrutinizing the future with humanistic objectives in view.

A similar trend is evident in the United States led by futurologists such as Kenneth E. Boulding, John Dixon, John McHale, Hasan Ozbekhan, John R. Platt, Alvin Toffler, Stuart Umpleby and Arthur Waskow. And here there is a new development, as imaginative as it is surprising, in the direction of "open-ended anthropology".

Thus futurology is more and more playing a part which it had not originally foreseen for itself. It is becoming a forum for the discussion of questions which had been pushed aside in the fever of scientific and technical progress during the last three hundred years, questions about the meaning of life and the ethics of human coexistence.

Whoever decides that the future can no longer be left to chance and an often inexorable fate, has to do more than merely "produce" and "act"; he needs to turn again to philosophy and look ahead to the "ultimate problems" so that, in tackling the immediate ones, he will have the welfare of future generations constantly in view.

Research into the future is thus particularly concerned with the problems that education will face in the years ahead.

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The world we want tomorrow

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Simulation techniques occupy a special place among normative methods. An attempt is made to envisage possible conflicts and possible future developments which have been overlooked.

Recently, a new trend in futurology has gained ground in every country. It makes men and women of every race and from every sector of the social system the focal point of its activities, and seeks to explore a broad range of their hopes and aspirations —biological, psychological, political and social.

Throughout Europe, futurologists such as Bertrand de Jouvenel (France), Dennis Gabor (U.K.), Ugo Spirito (Italy), Johan Galtung (Norway), A. Sörensen (Denmark), Fred L. Polak (Netherlands), Ossip K. Flechtheim (Fed. Rep. of Germany), Igor Bestuzhev-Lada (U.S.S.R.), Radovan Richta (Czechoslovakia), A. Apostel (Romania), Andrzen Sicinski (Poland), Edeling (German Democratic Republic), to name but a few of these specialists, are turning from technological forecasting and scrutinizing the future with humanistic objectives in view.

A similar trend is evident in the United States led by futurologists such as Kenneth E. Boulding, John Dixon, John McHale, Hasan Ozbekhan, John R. Platt, Alvin Toffler, Stuart Umpleby and Arthur Waskow. And here there is a new development, as imaginative as it is surprising, in the direction of "open-ended anthropology".

Thus futurology is more and more playing a part which it had not originally foreseen for itself. It is becoming a forum for the discussion of questions which had been pushed aside in the fever of scientific and technical progress during the last three hundred years, questions about the meaning of life and the ethics of human coexistence.

Whoever decides that the future can no longer be left to chance and an often inexorable fate, has to do more than merely "produce" and "act"; he needs to turn again to philosophy and look ahead to the "ultimate problems" so that, in tackling the immediate ones, he will have the welfare of future generations constantly in view.

Research into the future is thus particularly concerned with the problems that education will face in the years ahead.

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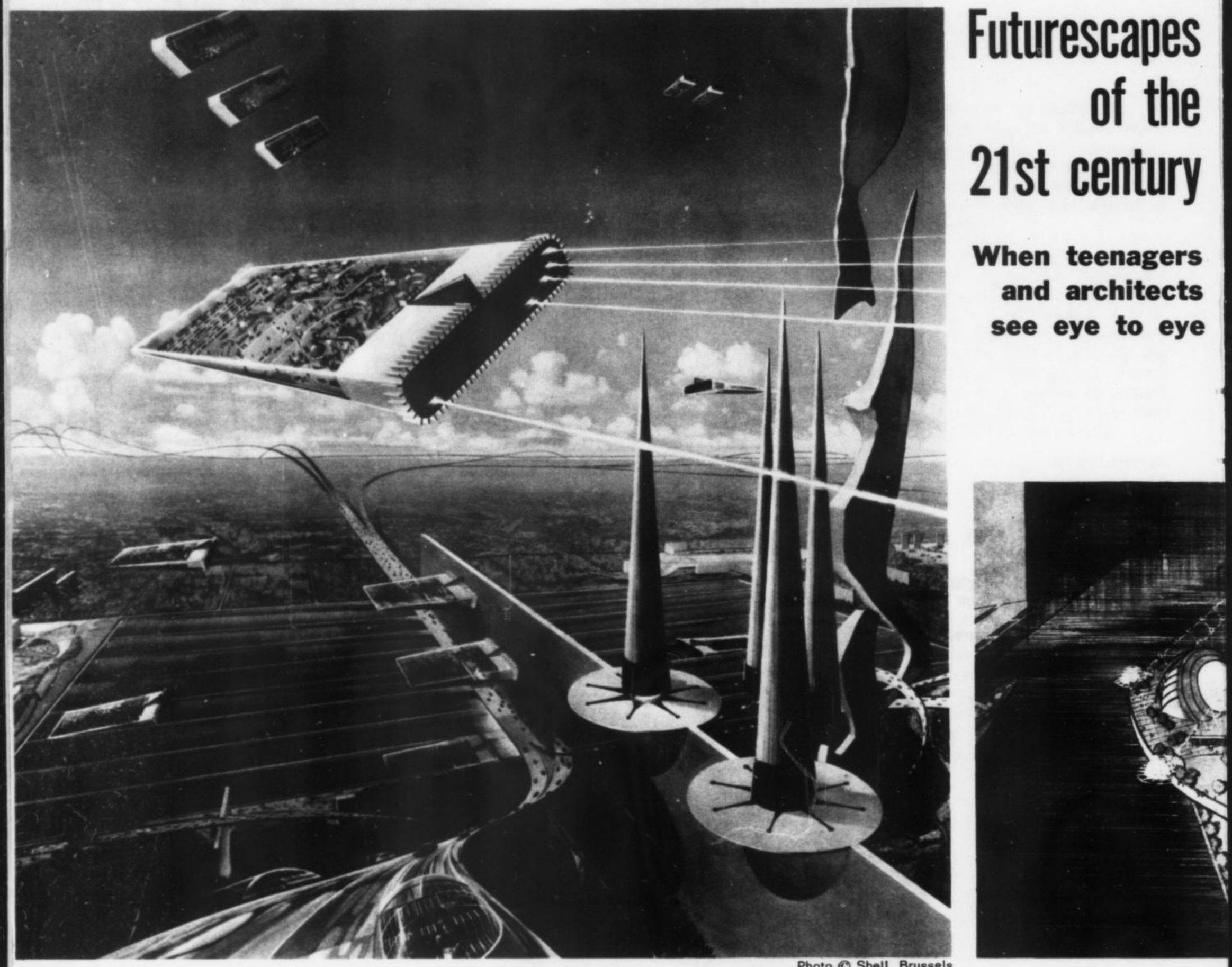

Photo © Shell, Brussels

Futurescapes of the 21st century

When teenagers and architects see eye to eye

BREAKTHROUGH TO TOMORROW *(Continued)*

The American Census Bureau estimates, for instance, that 125 million U.S. children will be of school age in the year 2000. Developing countries will have an even more spectacular rate of increase. By the end of the 1970s, nearly four times as many children as today in these countries will be attending school until the age of 14. The number of university students should rise more slowly. Nevertheless, by 1985 it is expected to double and even treble in some countries.

The time spent in school is also expected to increase. Kjell Eide, of the Norwegian Ministry of Education's Planning Department, recently carried out for the Organization for Economic Co-operation and Development, in Paris, a "prospective analysis" of Norway's education needs.

His conclusion was that school attendance for Norwegians, before they start work, would leap from an average of seven years in 1930 to an average of 11.5 years by the end of 1970 and would average 14 years by 1990. This would mean that not only a privileged few, but all young Norwegians would then be attending school until the age of twenty.

However, the aim of futurology is not only to assess the educational problems and possibilities of tomorrow, but also to prepare the ground for new teaching methods.

Robert Tschirgi, Head of the Department of Academic Planning of the University of California, believes that the computer "represents the greatest opportunity for innovation since the invention of the printing press."

Data processing machines and programmed instruction will adapt the rhythm of tuition to suit the individual pupil and will check more accurately than a human teacher the amount of knowledge that has been retained. Furthermore, such teaching machines will train children to discover the facts for themselves, to compare and to assess them.

By leaving the pupil alone at his desk to do his work in short, logical stages, programmed instruction will, it is hoped, free the teacher of the future to undertake more personalised teaching.

But who will draw up the programmes? Who will make the films in which famous scientists will record their lectures for thousands of students? Who will produce the films and tape-recordings which will in part replace text books? Who will prepare the televised classes? Will a large scale "teaching industry" develop? These are some of the questions of vital social significance which the futurologists have to consider.

Imaginative drawings in which young people from different countries portray their ideas about the city of the future were a popular attraction at a recent "Science and Science Fiction" exhibition in Paris. A selection is presented here and on pages 18 to 21, alongside designs for cities of the future made by adult architects and artists. A 14-year-old Paris schoolgirl drew the "futurescape" (right) with its pinnacled buildings topped by spiral antennae and an airspace crammed with satellites. The flying cities soaring over a futuristic panorama (opposite) were conjured up by an artist for a calendar depicting the world of tomorrow, published by an oil company in Belgium in 1962. The housing complex (below) was a project designed for a New York site by Frank Lloyd Wright, shortly before his death in 1959.

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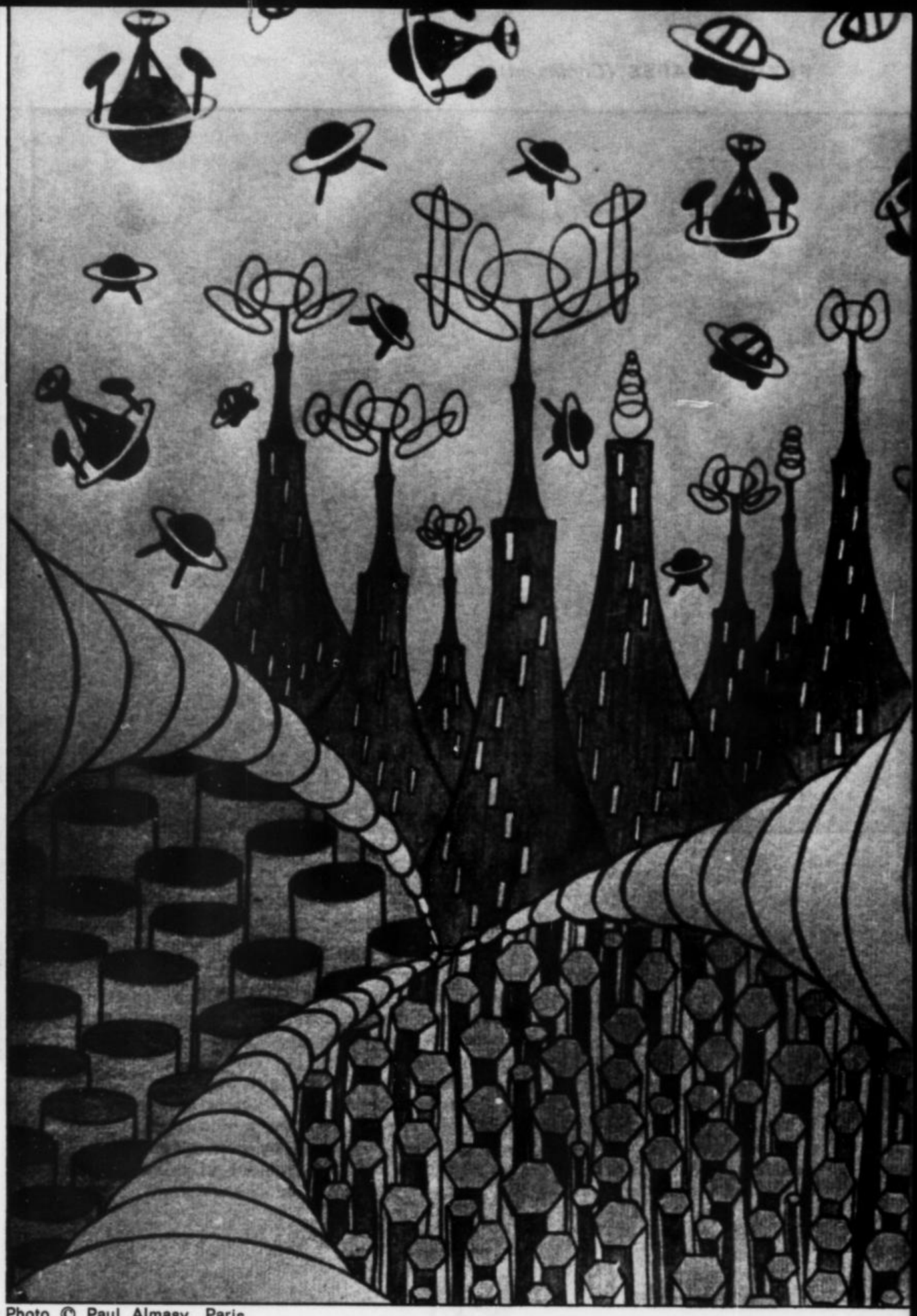
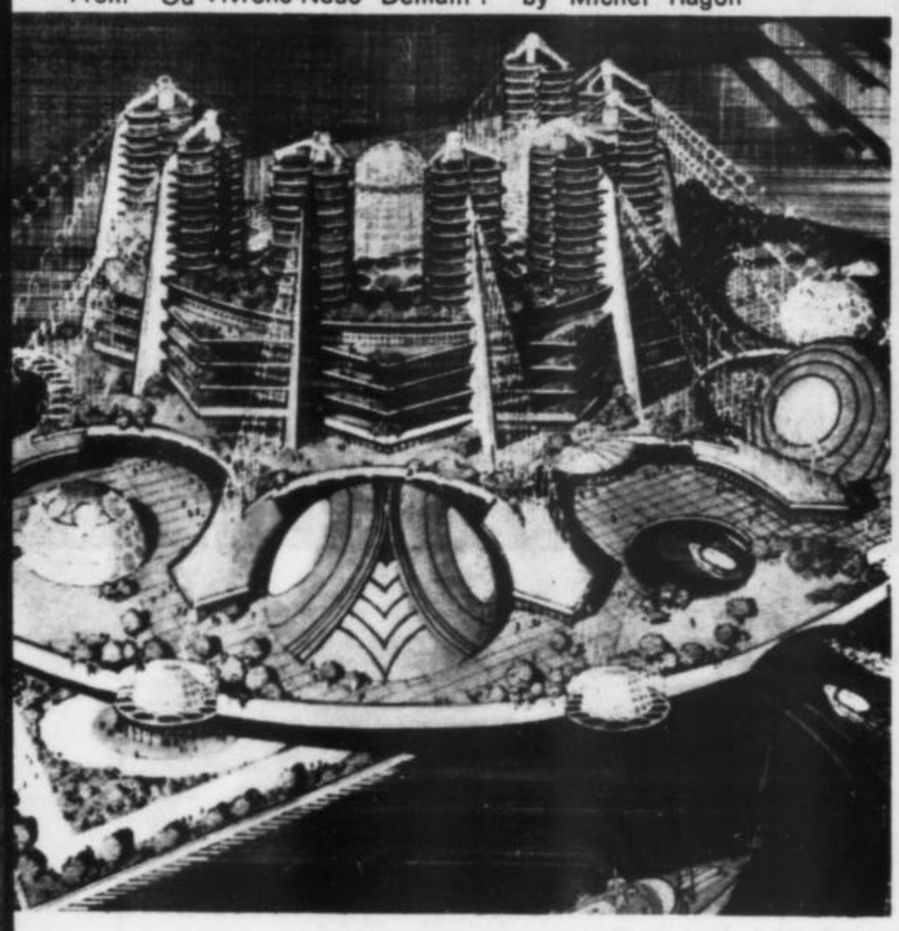


Photo © Paul Almasy, Paris

Photo © Editions R. Laffont, Paris
From "Où Vivrons-Nous Demain ?" by Michel Ragon



In dealing with economic questions, as in any other field of forecasting, futurology needs to take a global view and utilize the expertise and resources of numerous disciplines.

The trends of population growth are a major factor in economic forecasting. Within the span of half a lifetime (that is, in thirty-five years) the population of the world will probably have doubled. This is one of the most important of almost all economic considerations. The production of food and clothing and the building of homes for an extra three thousand million persons will gradually take priority over all other economic problems.

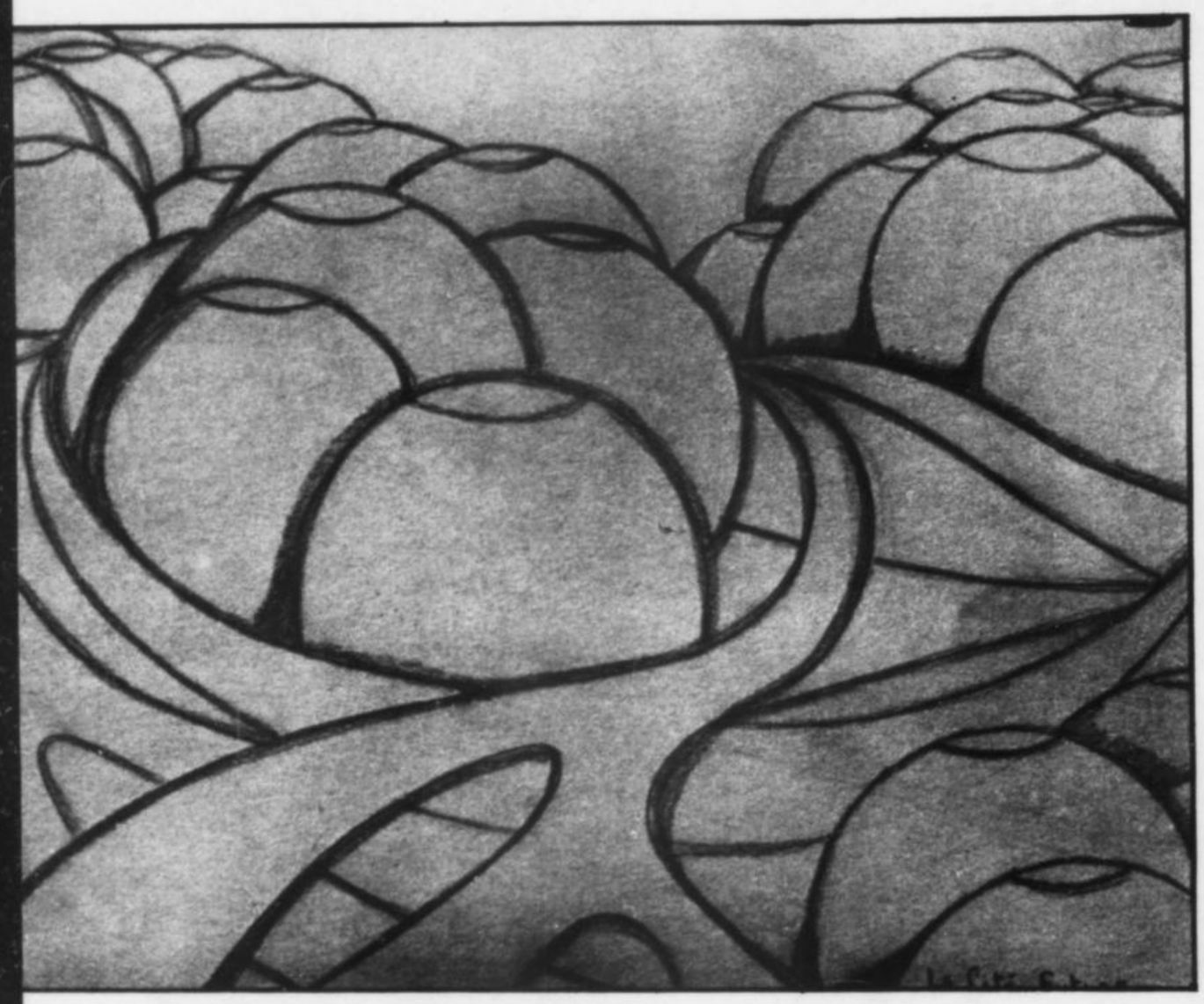
Economic resources will be mobilized more and more to cope with social problems. Air and water pollution, noise, traffic congestion, the deterioration in the quality of life through the mass "herding" and monotony of urban living are all, in large measure, the consequences of a philosophy of life which has laid too much stress on economic achievement while giving scant regard to the high price that has to be paid for it.

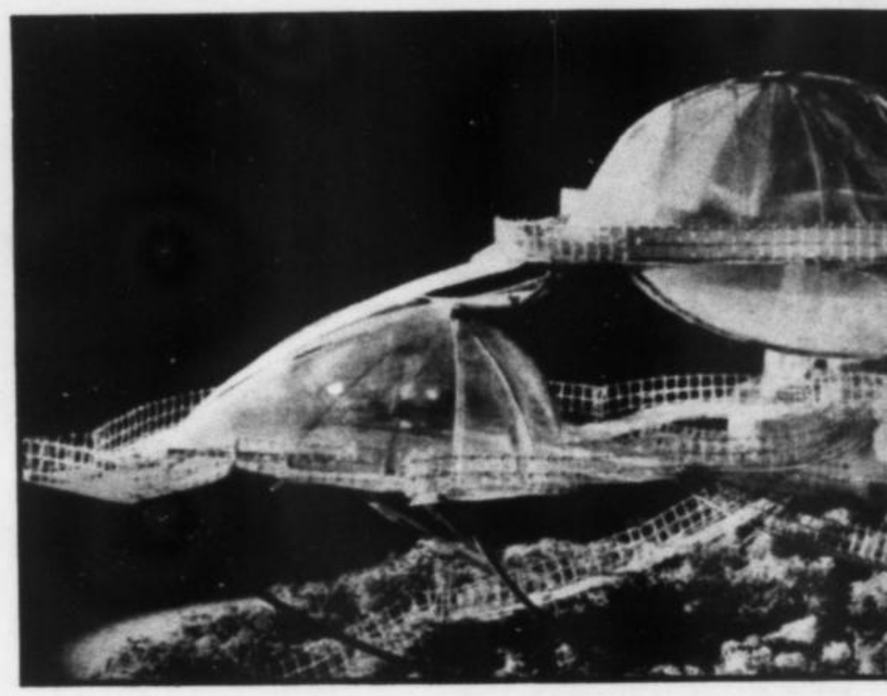
Economic exploration of the future will thus need to be more concerned with problems of professional life and with opportunities of employment. In the very near future, it will become almost as important to create new jobs as to manufacture goods.

The need for a fairer distribution of jobs, large scale and properly timed vocational retraining to meet frequently changing needs, a totally different outlook on work, viewed as a "possibility" and no longer an "obligation," will require economists to give special consideration to psychology, the study of behaviour, and philosophy. Questions about "the meaning of life" will often be raised in the economic sector. "Homo Economicus" is already considered by the younger generation as a limited, even atrophied form of man; soon he will be looked upon as no more than a relic of history.

Exploration of the future which aims to serve mankind needs to consider not only those alive today ; it should keep in mind the needs of coming generations. Futurologists will accomplish one of their most important tasks if they regard themselves as the "defenders of those not yet born", whose conditions of life have already become endangered by lack of foresight on the part of 19th and 20th century man.

Even if the new efforts deployed to explore the future achieved nothing more than a strengthening of the feeling that we today are responsible for the welfare of those who will follow us, it would by that alone have proved its worth. ■

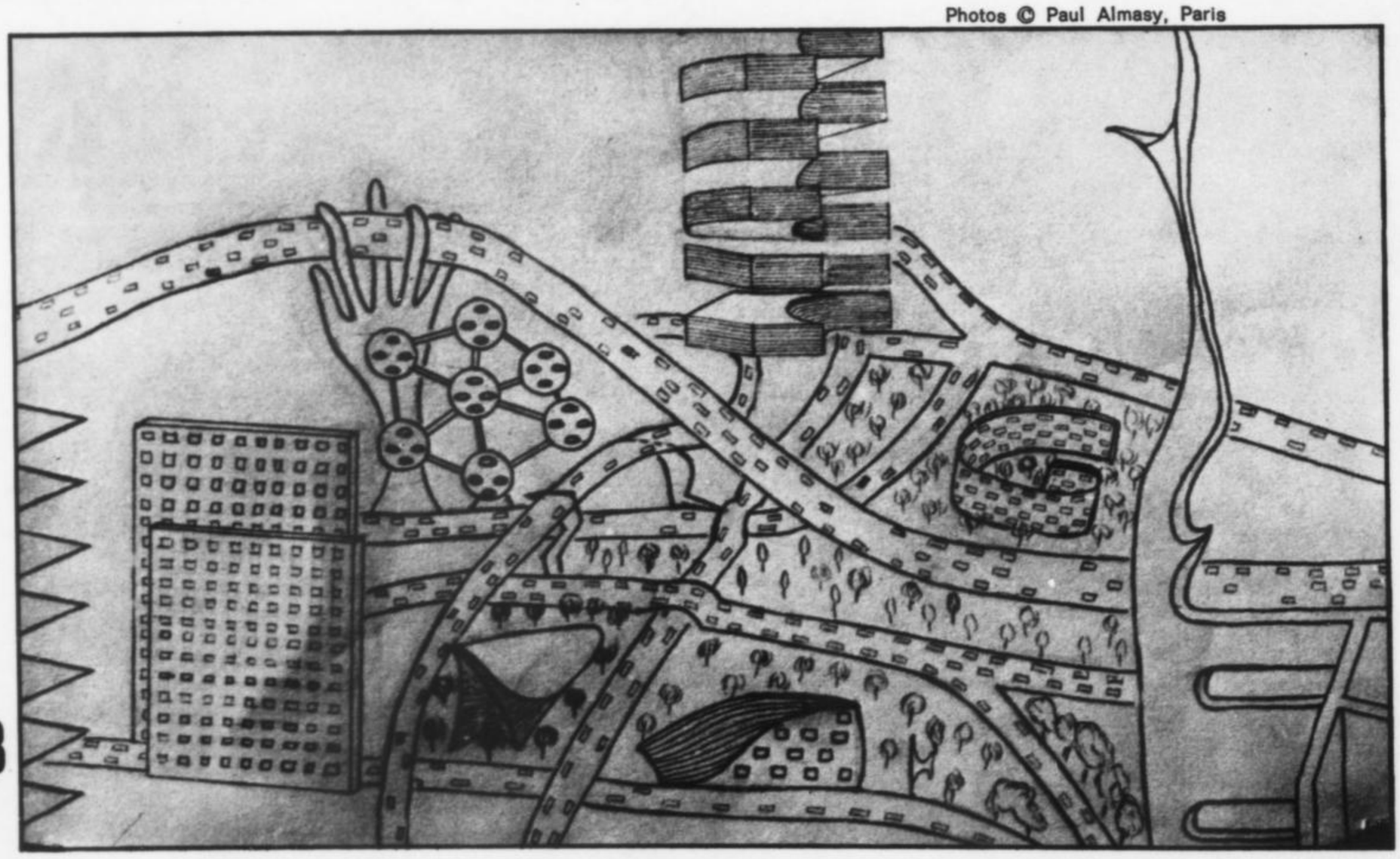




"There's no place like dome" is what people may say of these cupola-shaped houses of the future (right). Part of a project designed by the American sculptor and architect Bernard Redek, these buildings would be constructed with synthetic materials, suspended in mid-air on metallic arc-shaped supports, and encircled by a network of access roads. Similar domelike structures set between interlacing motorways figure in "The City of the Future" (above) visualised by a 14-year-old French girl, and also in "The World of Tomorrow" (above right) as imagined by a young Japanese boy. In the city, below, drawn by a teenage Paris student, busy highways criss-cross and at one point climb upwards supported by a giant hand. Beside the hand, seven spheres represent an arrangement of atoms in a giant model symbolizing the peaceful uses of atomic energy.

'NO PLACE LIKE DOME'

Photos © Paul Almasy, Paris



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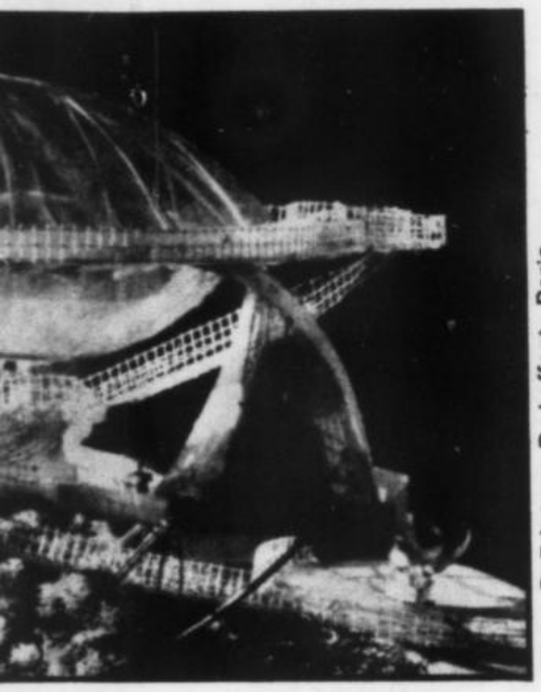

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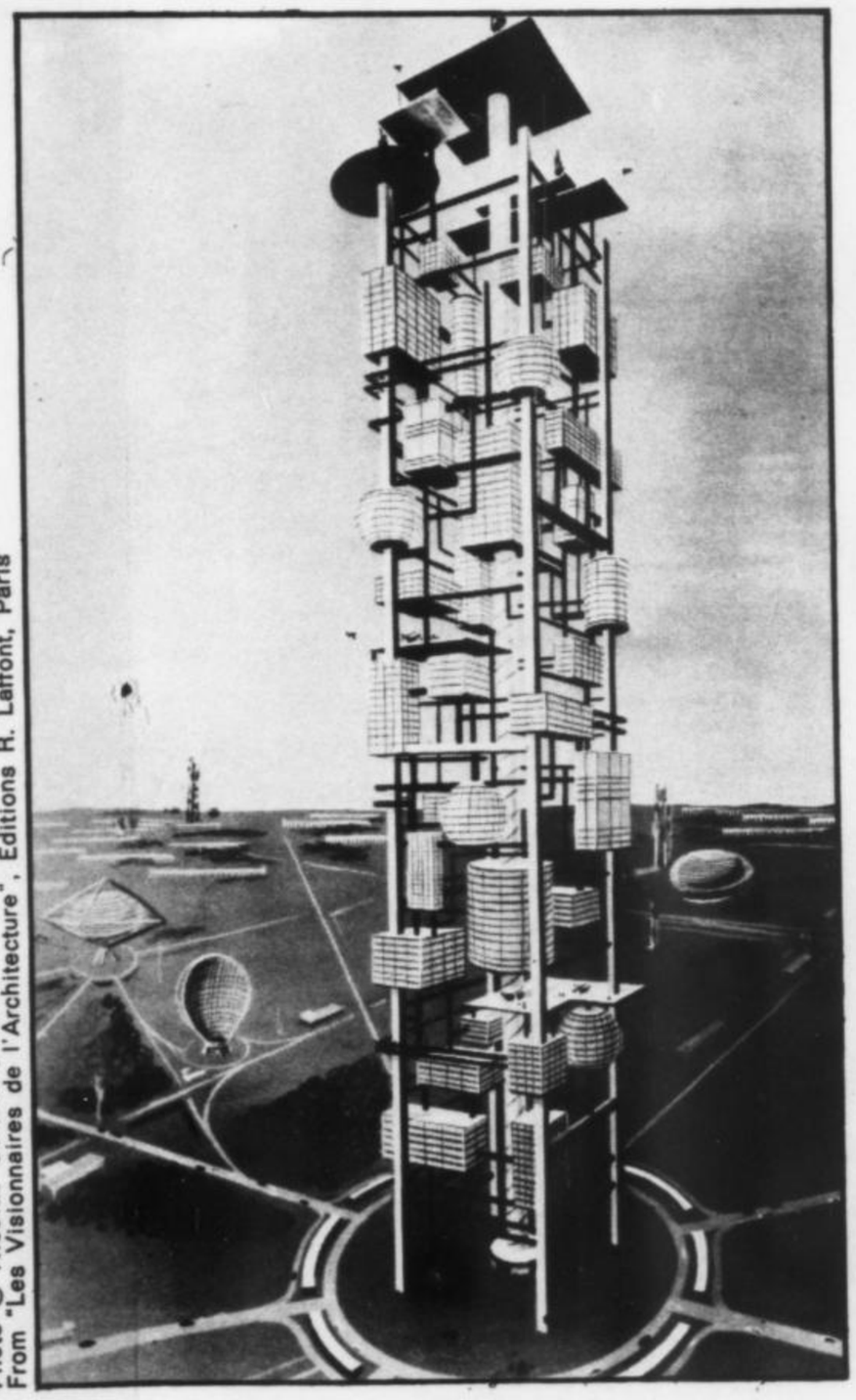
From "Où Vivrons-Nous Demain ?"
by Michel Ragon



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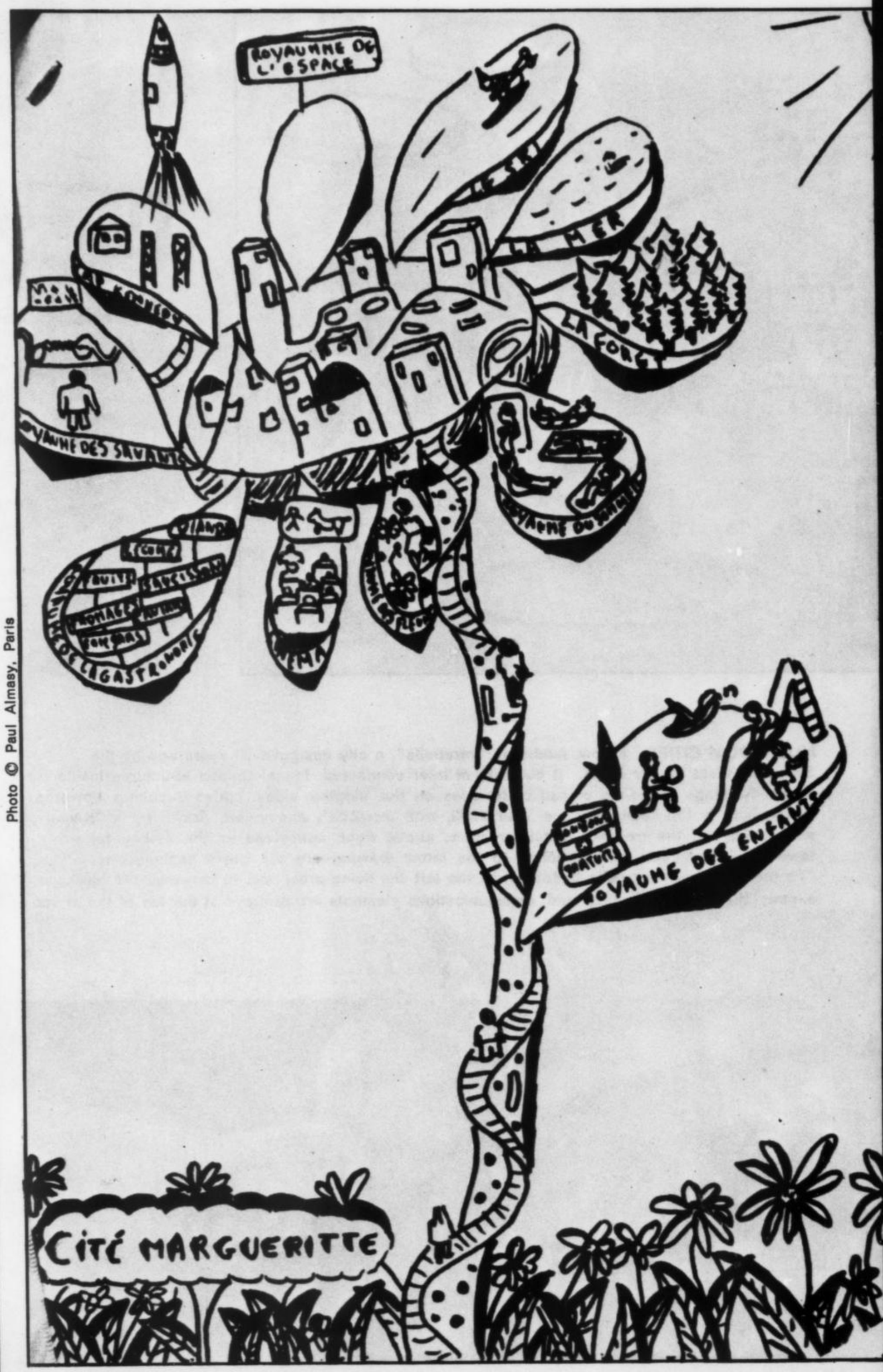

Photo © Paul Almasy, Paris

MILE-HIGH UNIVERSITY. This "up-ended" university campus (left), soaring skywards for over 1,200 metres (almost a mile) would house 30,000 students. Designed in Paris by the famous sculptor Nicolas Schöffer, it is a feature of his project for a "dynamic-space" city—half "working" city and half "recreation" or "fun" city—in which Schöffer alternates horizontal and vertical buildings. The flower-petal city rising into the sky (above) is proposed by a 15-year-old French schoolgirl. Her "Daisy City" as she calls it appears to have everything except a lift to reach it: a children's paradise (with unlimited sweets), petal "neighbourhoods" for gastronomy, cinema, flowers, the forest, the sea, ski-ing, as well as a "realm of sleep". A busy space programme is in operation at "Cape Kennedy"; alongside, an empty petal is held in reserve for still undetermined uses.

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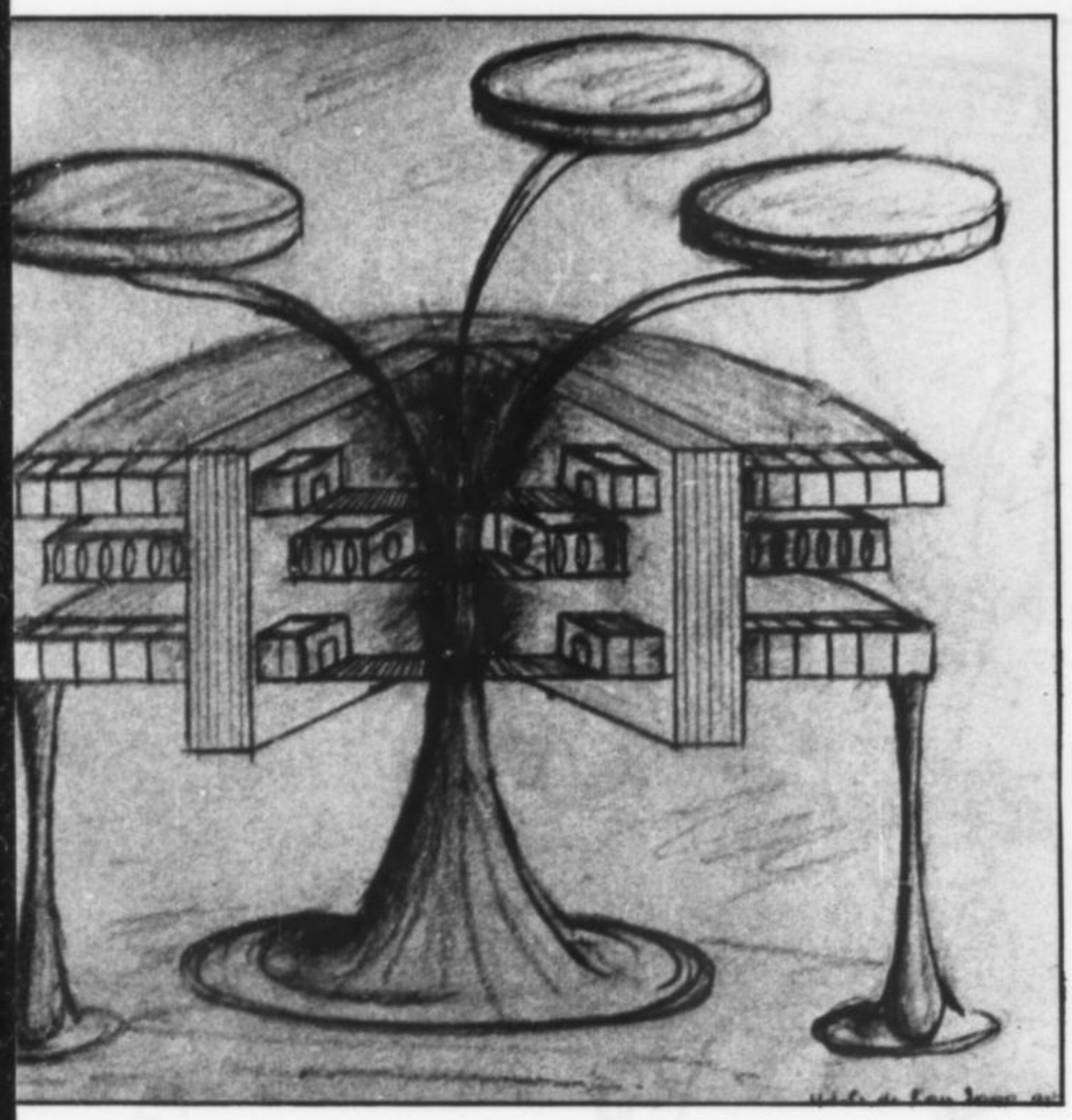
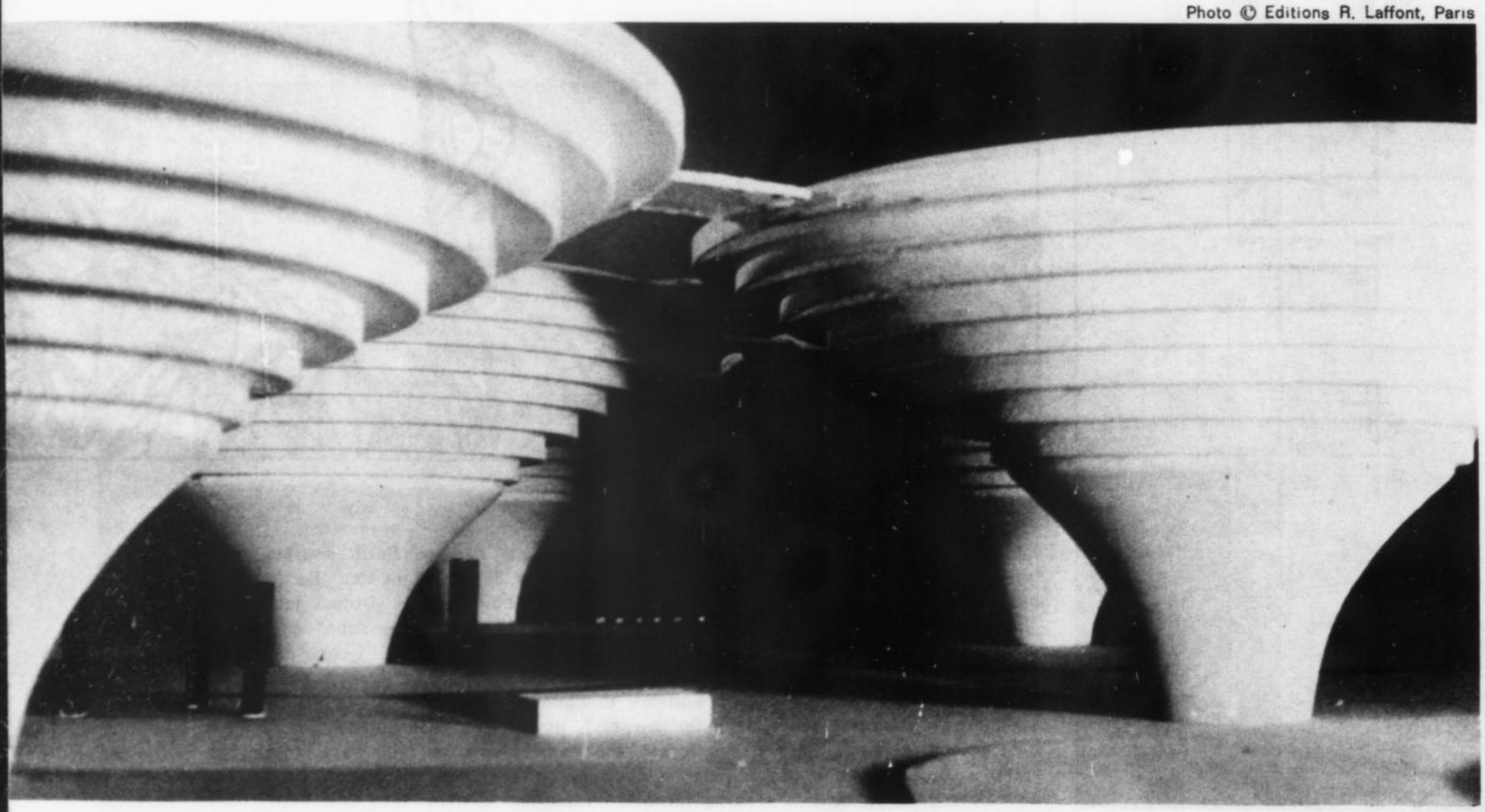


Photos © Paul Almasy, Paris

MUSHROOM CITIES. Below, model of "Intrapolis", a city designed 50 years ago by the Swiss architect Walter Jonas. It consists of inter-connected, funnel-shaped structures inside which dwellings would be placed in terraces on the sloping sides. Also reaching upwards to the light is the "Hotel for the Year 2000, with terraces", above left, drawn by a 16-year-old schoolboy, and the tree-like metal structure, above right, conceived as the setting for a town by a boy aged 14. Attached to the latter drawing are the boy's explanations: "To the right are the public buildings, to the left the living area, and, in between, the business centre; the power, heating and communications elements are grouped at the top of the structure."

RAISED TERRACES AND SUNKEN ISLANDS

Photo © Editions R. Laffont, Paris



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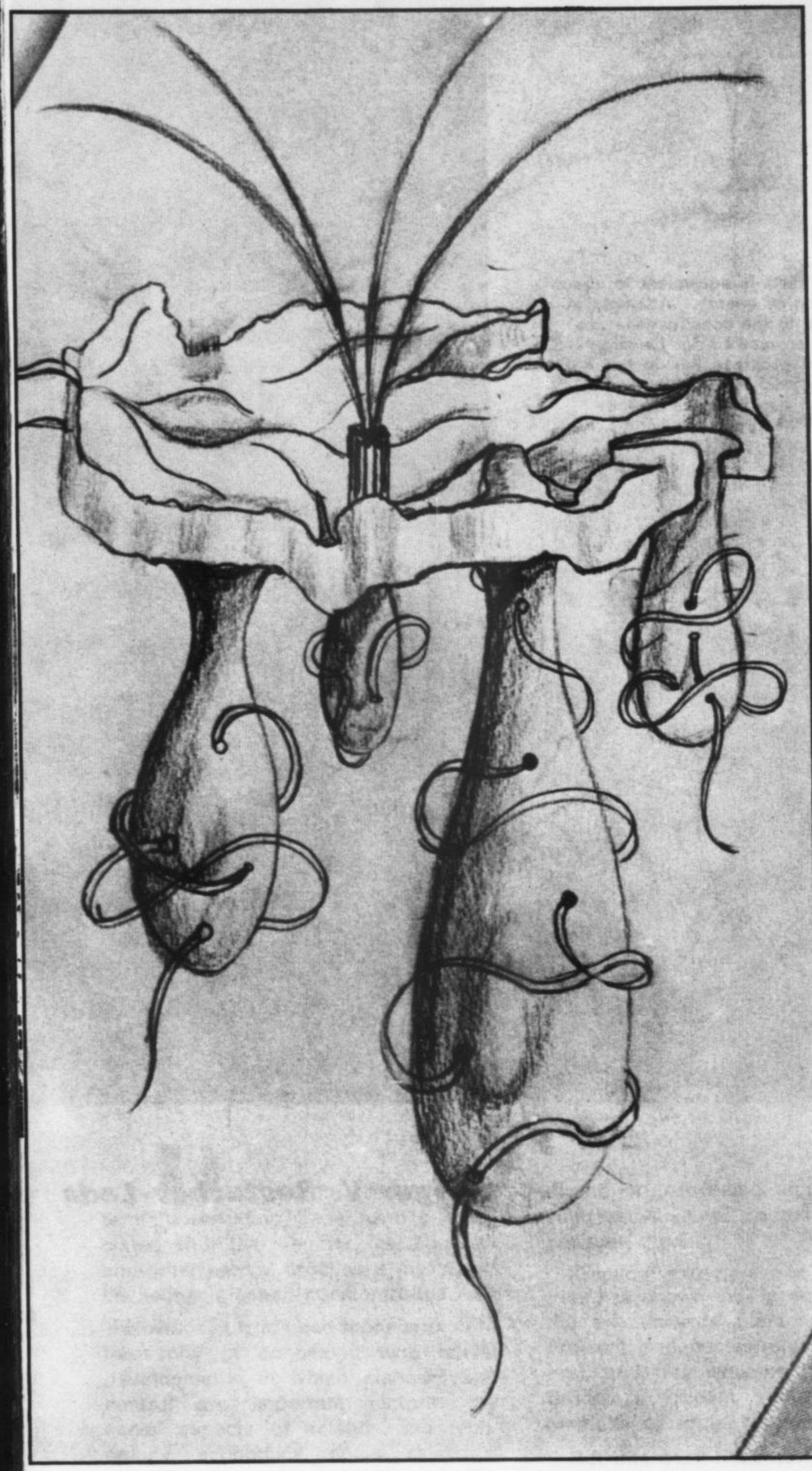


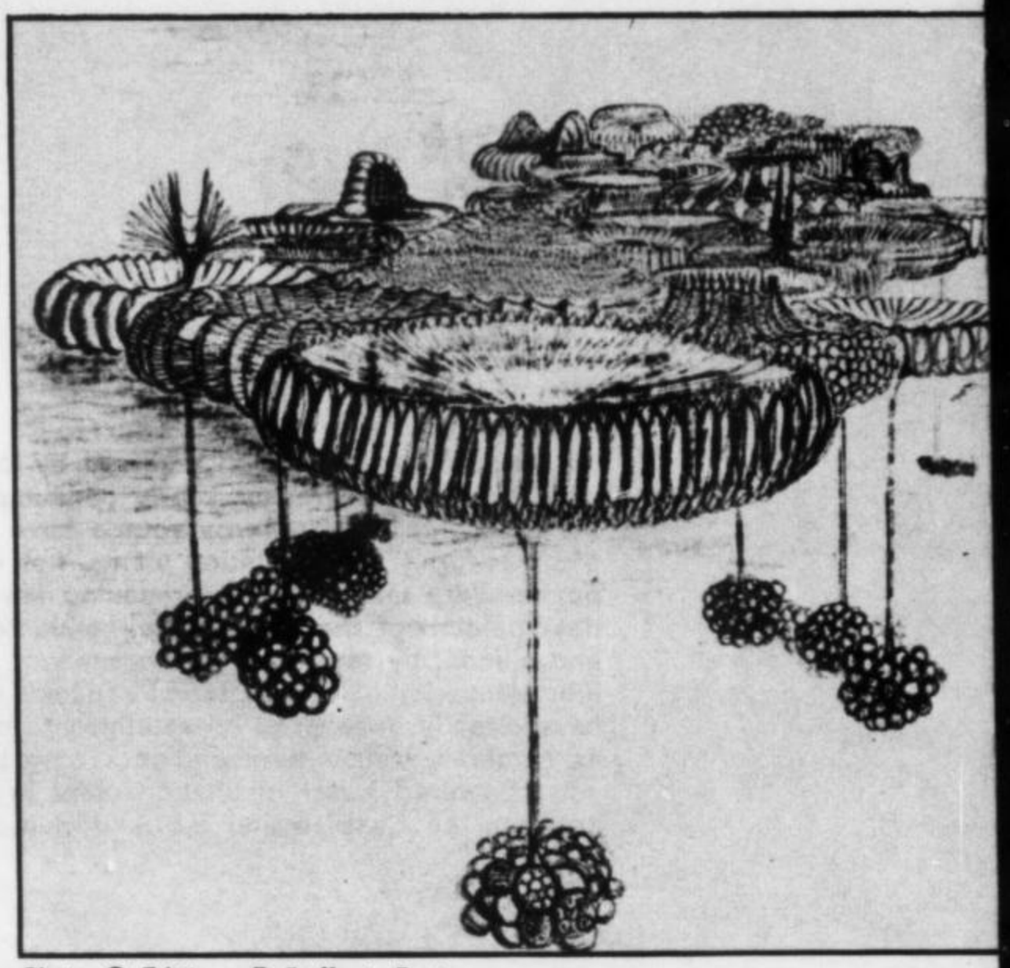


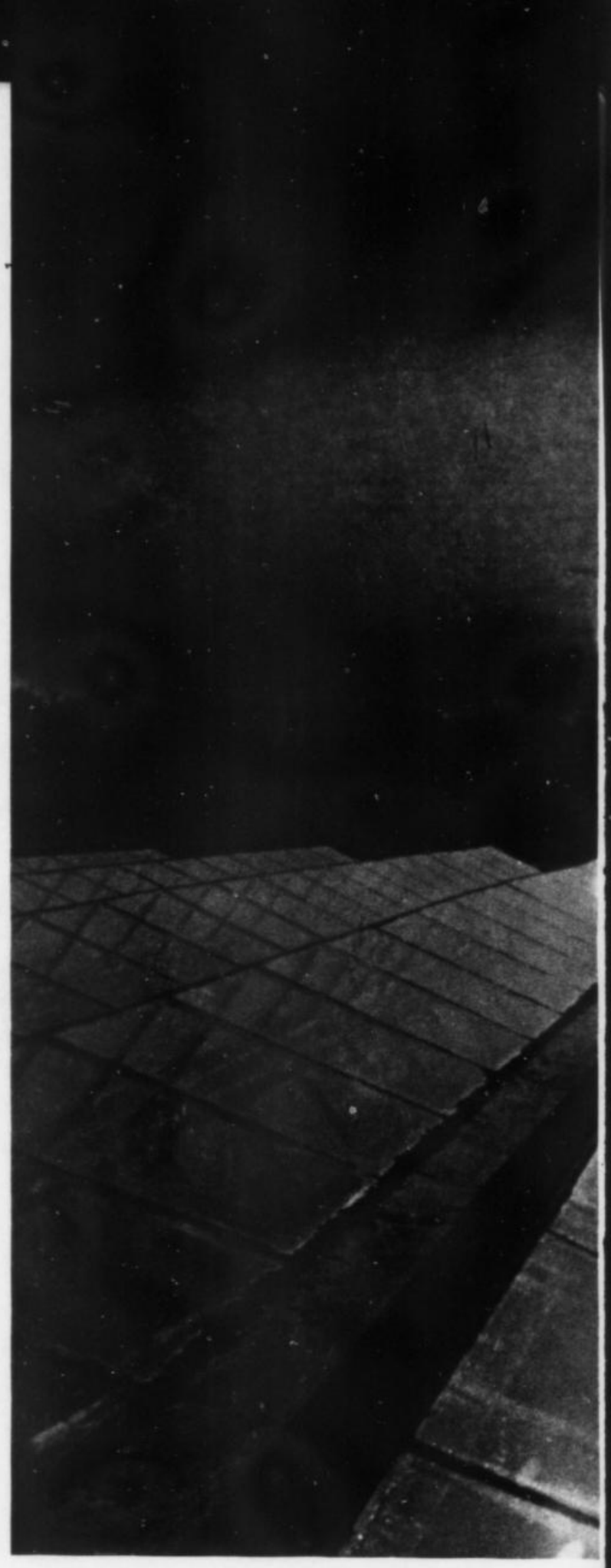
Photo © Editions R. Laffont, Paris
From "Où Vivrons-Nous Demain ?" by Michel Ragon

Photos © Paul Almasy, Paris

OCEANOPOLIS. Why not take a tip from the Aymara Indians of Lake Titicaca, who live on floating, artificial islands made of woven reeds, and build floating cities? The American architect William Katovolos sees nothing bizarre in this idea and has designed a floating city using plastic materials, top right. If cities can be built on the sea, why not submarine cities? Commandant Cousteau has already shown the way with his underwater houses. A 15-year-old schoolgirl envisages a whole underwater city composed of vast, sack-like living areas suspended from a leaf-shaped surface float, above. An 11-year-old Japanese boy sees man the scientist dominating the underwater world with a complex system of aeration and exhaust pipes (right). His "oceanopolis" would be inhabited by a hardy people to whom skin-diving would be as normal as walking.

XUM

The annual solar radiation received by the earth is equivalent to about 35,000 times our present yearly consumption of energy. Attempts at harnessing this vast energy source have led to the construction of solar furnaces, distillation plants, hot water systems for housing, etc., powered by the sun. A promising line of progress lies in the further development of the use of semi-conductors, such as germanium and silicon, by means of which sunlight can be converted directly into electricity. Solar batteries consisting of hundreds of silicon cells have already been used on satellites to power instruments such as cameras, transmitters and recording apparatus. Right, a Soviet solar powered water distillation plant in the Kara-Kum desert between the Caspian and the Aral Seas.



A SOVIET SCIENTIST LOOKS AT FUTUROLOGY

by Igor V. Bestuzhev-Lada

IGOR V. BESTUZHEV-LADA, *a leading Soviet futurologist, heads the Section for Social Forecasting of the Institute of Concerted Social Research (U.S.S.R. Academy of Sciences). He is also director of the Social Forecasting Research Institute of the Soviet Sociological Association. Dr. Bestuzhev-Lada has published numerous books on futurology, including "If the World Disarms", "Outlines of the Future", and "Modern Problems of Social Forecasting" (all in Russian).*

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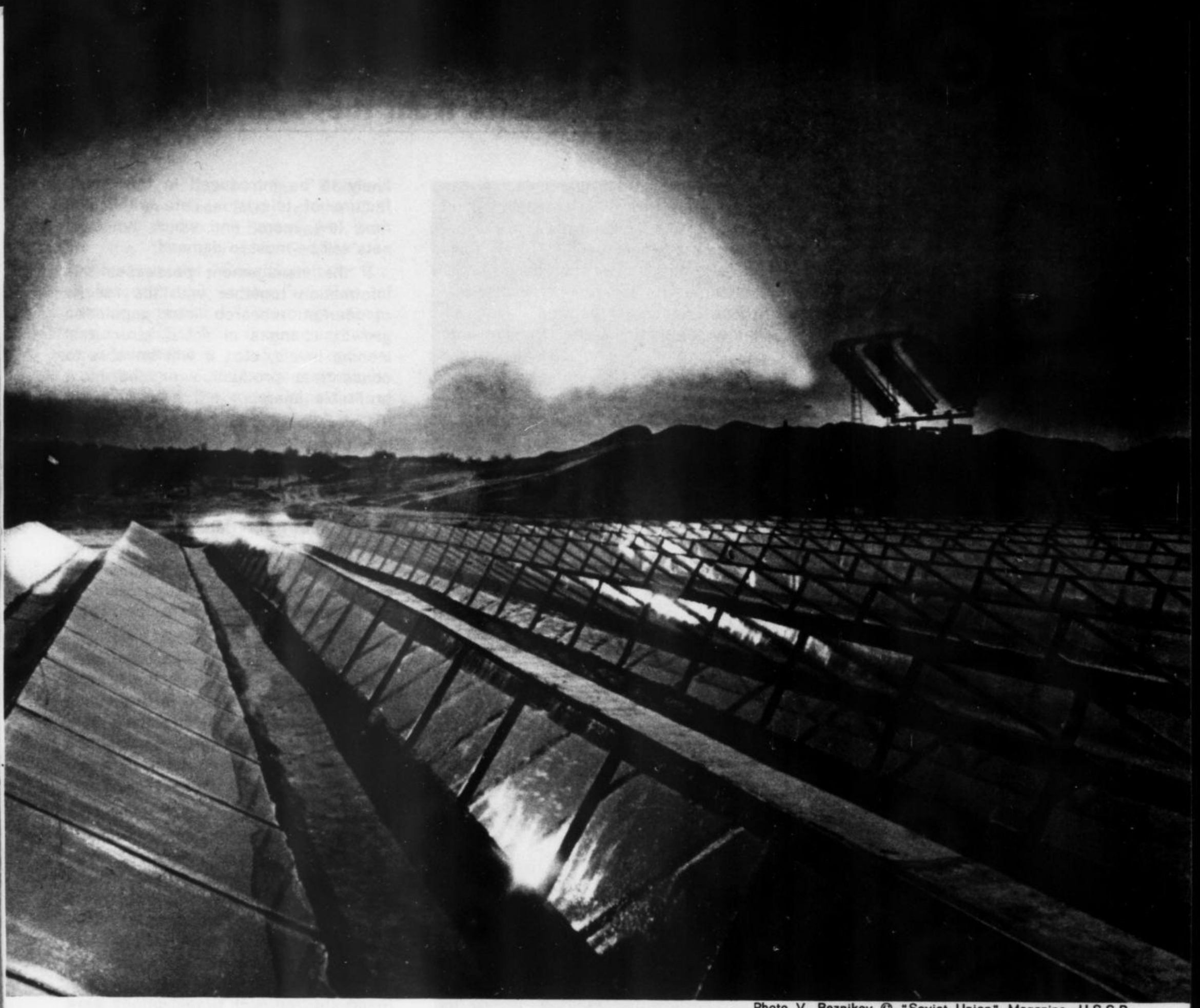

Photo V. Reznikov © "Soviet Union" Magazine, U.S.S.R.

UNTIL quite recently the term "forecasting" was usually associated with the weather, earthquakes and other natural processes that could be neither planned nor controlled.

Nowadays it is used more and more frequently in connexion with social developments in which planning and control are important factors: the social aspects of science and technology, economics, social relations, urban development, education, health services, state organization and law, politics, international relations, military affairs, the development of vast expanses of our planet and the exploration of space.

One might ask why we need to forecast things that can be planned and controlled. The answer is that every decision in planning and direction must have a sound basis and offer, as far as possible, the best chance of success. The purpose of a forecast is to provide relevant data, to evaluate both the probable and the desirable results of the project being studied, and to suggest ways of reducing the gap between them.

Practical experience in many countries has shown that forecasting raises the efficiency of plans, programmes, projects and decision-making in general, and this explains the extensive growth in recent years of various methods of social forecasting.

But this does not mean, as is sometimes claimed, that scientific forecasting is of recent origin. Over a century ago, Karl Marx and Friedrich Engels demonstrated that it was possible to analyse future problems scientifically. They prognosticated future developments by analysing existing trends, and used what have now come to be known as the systematic approach, social modelling, social norms, etc. In short, their methodology of forecasting anticipated the demands of modern science. Nowadays, the forecasting and planning of social processes are taken for granted, but in the mid-19th century, the work of Marx and Engels represented a bold, new scientific approach.

Research into the future is nowadays developing under the impetus of the scientific and technological revolution and its social implications, and recent qualitative changes in many spheres of human activity show how important it is to make exhaustive appraisals before plans are drawn up or decisions taken.

The search for solutions to pressing social problems has already produced hundreds of practical methods for forecasting over relatively long periods and with a comparatively high degree of accuracy, and has led in many countries to the appearance of specialized institutions and groups whose aim is to produce realistic social forecasts with these methods and to develop still more reliable techniques.

Such forecasting is particularly necessary and effective in countries

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Spectacular results from the 'systems approach'

with state-planned economies. A case in point is that of urban development in the Soviet Union where, in the past few years alone, over 100 new towns have sprung up in accordance with a state plan for the rational implantation of new industrial centres. Naturally, state ownership of the land facilitates the forecasting and carrying out of such projects.

One could say that social forecasting is based on combinations of several methods:

- Opinion-gathering through polls of various sectors of the population and systematic questioning of specialists;
- Advanced extrapolation, that is, the verification and analysis of data from direct extrapolation, using modern mathematical methods and cybernetics and the complex techniques of game theory, the theory of probability, the theory of functional research and the theory of decision-making;
- Forecast modelling based on the "systems approach" (a method which has already produced spectacular results in the field of space research).

Two main types of forecasting models are used: the "exploratory" method, which aims to answer the question: "what will happen if the present trend in this or that field continues unimpeded?"; and the " normative" forecasting method, where the question posed is "what would be the desirable, optimal development of the process we are studying?"

Practical experience has shown that short term (1-2 years) and medium term (3-7 years) exploratory forecasting is between 95 and 98 per cent reliable. As yet this cannot be said of long term forecasts (10-20 years or more).

However, it is not only a question of whether a forecast eventually comes exactly true or not; more important still is for the forecasts to raise the efficiency of programmes, projects and decisions. Social forecasting has already shown that it can double or even treble the profitability of an enterprise, reduce planned expenditures by as much as 5 to 10 per cent, and speed up decision-making considerably.

A simple example will help to demonstrate the practical advantages of forecasting. In a factory manufacturing television sets, it is obviously important for the planning department to know what technological changes are likely to be introduced in the manufacture of television sets within the next few years, and which types of sets will be most in demand.

If the management possesses this information together with the results of market research into population growth, changes in social structures, income levels, etc., it will be able to concentrate production on the most profitable lines.

Forecasting is nowadays often spoken of as a new scientific discipline —a "science of the future". But though we are now witnessing the birth of a new science, it is not a science of the future in general. This new discipline is concerned with the *laws and methods* of forecasting, and to distinguish it from forecasting proper it is frequently referred to as "prognostics".

Forecasting as such, just like analysis or diagnosis, is an essential function of the sciences and in this sense it is not a new but a vigorously developing trend of modern scientific research.

A measure of its development is the fact that in 1970, 293 organizations in western Europe were engaged in drawing up complex, long-term social forecasts, including 84 in Britain, 70 in France, 33 in the Fed. Rep. of Germany, 22 in Italy, etc. Several dozen such organizations were also operating in Japan. And these figures do not include research units engaged in short-term forecasting or futurology research for specific projects.

In 1967, some 600 similar institutions were operating in the U.S.A., but saturation point was reached and their growth stopped. Hardly a single large corporation, firm, board or institution was without its own forecasting service.

Later, demands for complex, long-term forecasts gradually came to be handled by the bigger U.S. research organizations and the top experts in the forecasting field. Of the 356 organizations of this kind operating in 1970, various government-operated or government-subsidized, services accounted for about one-half, corporations for a third, universities for a sixth and various foundations for about a tenth.

The most influential of the futurology research organizations in western Europe and America include the "Futuribles" organization, in Paris, "Man-

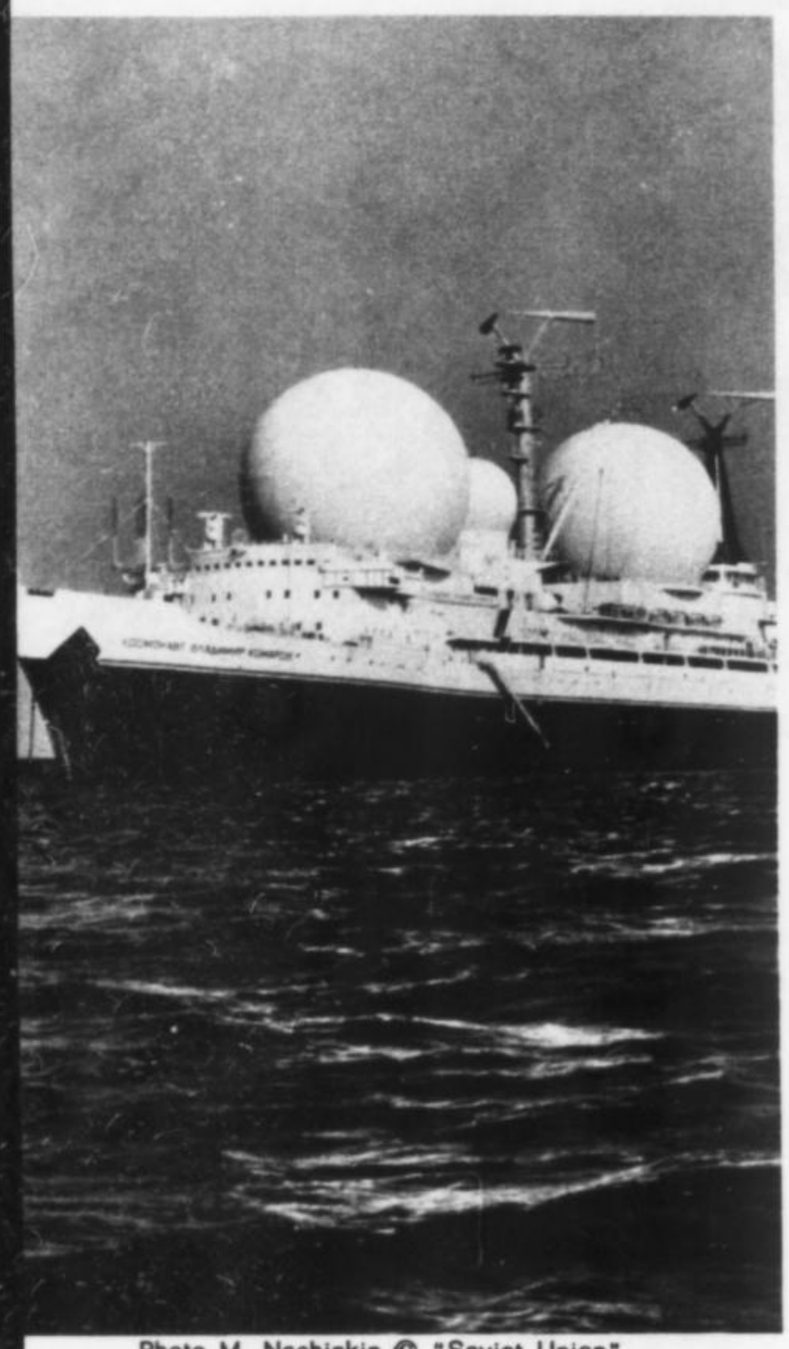


Photo M. Nachinkin © "Soviet Union" Magazine, U.S.S.R.

Named after Vladimir Komarov, one of the first Soviet cosmonauts, this U.S.S.R. research ship is a floating oceanographic laboratory and satellite tracking station. Its unusual superstructure wedded to its traditional hull seems to symbolize the blurring of the once rigid demarcation between present and future.

kind 2000", in London, the "Commission for the Year 2000," at the U.S. Academy of Arts and Sciences, in Boston, the "World Future Society", in Washington, the "Gesellschaft für Zukunftsforschung", in the Fed. Rep. of Germany, and the "Futurology Association of Japan." In recent years they have convened a number of national and international conferences and symposia, among the most important of which were the international future research congresses held in Oslo, in 1967, and Kyoto, in 1970.

The 1960s saw the founding of specialized magazines such as "Analyse et Prévision" and "2000" (France), "Futurist" (U.S.A.), "Futurum" (Fed. Rep. of Germany), "Technological Forecasting" (U.S.A.), and "Trend" (Czechoslovakia).

In the U.S.S.R. special departments have been set up to work on the theoretical problems of social forecasting, and several hundred groups of scientists are carrying out applied research and drawing up precise forecasts for factories, industrial groups and indeed entire industries.

The U.S.S.R. Academy of Sciences and Soviet ministries are now very active in these fields. For example, the scientific councils of the Academy of Sciences concerned with planning, social research, etc., have set up special sections to co-ordinate the work of forecasting specialists on various boards and institutions, while members of the Soviet Sociological Association have founded a Forecasting Institute which conducts permanent seminars where experts meet to compare notes on their work.

Specific forecasts have already been made in the U.S.S.R. concerning developments up to the year 2000 in fuel and power, the water economy, hydro-power construction and transport. Long range problems of science (the manufacture of new materials, the greater use of chemistry in production, the future possibilities of biology, etc.) have been studied, and a scientific estimate has been made of the extension of higher and specialized secondary education in the 1970s.

Social forecasting services are being set up in the German Democratic Republic and Bulgaria. In Poland, a state committee, "Poland in the Year 2000", has been established under the chairmanship of the Vice-President of the Academy of Sciences. Similar research groups are being set up in Czechoslovakia, Romania and Hungary.

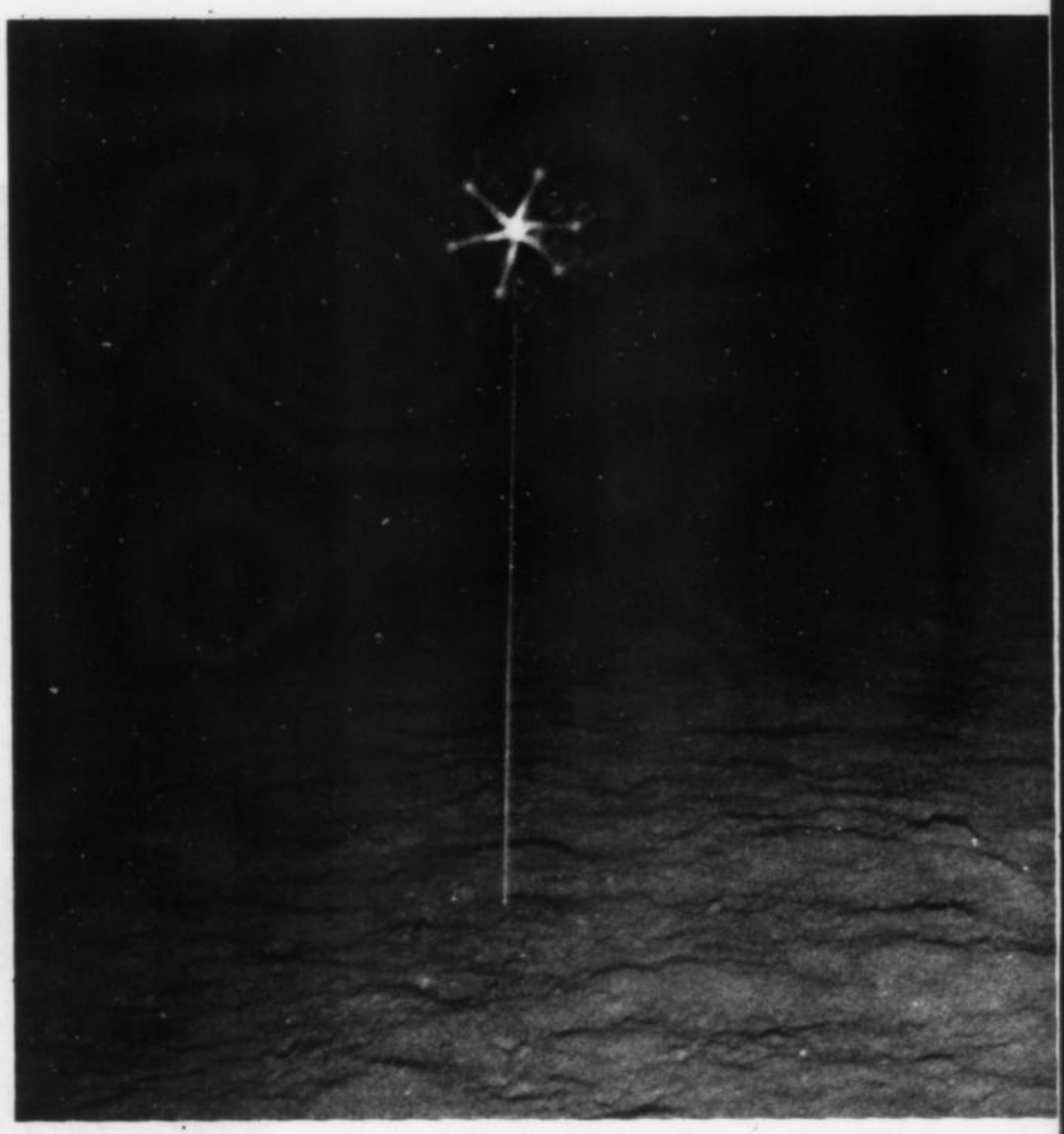
Symposia, which brought together

CONTINUED PAGE 27

Photo © Life Magazine, Paris

Mimicking the movements of a human arm and hand with ghostly precision, this Soviet-developed artificial arm and hand unit brings new hope to amputees. Myoelectric impulses (the tiny electrical impulses emitted when a muscle contracts) are picked up by electrodes attached to the stump of an arm, amplified and used to activate a miniature motor which opens or closes the artificial hand. Amputees fitted with these ingenious false limbs can undertake such delicate tasks as shaving, sewing, painting and model-making. Thanks to the almost incredible advances made in electronics, the machine has indeed become an extension of the human brain.

Photo © Hasselblad, Sweden



MAY SIGHTS YOU ~~WILL~~ NEVER SEE

Unless you are selected for a space flight or a voyage of exploration of the ocean bed, you will never see the sun eclipsed by the earth, above left, or this submarine "snowflake" growing on the ocean bed 5,300 metres below the surface of the sea, above right. To future generations, or even to children now alive, such sights may one day be commonplace. But if most of us are still chained to the more pedestrian life (below) of this planet, futurology can open up a tempting vision and in our imagination we too can scale the heights and plumb the depths of the universe.

XUM

Photo Walter J. Hahn © U.S. Oceanographic Office

Photo © Richard Frieman, Paris

representatives from the East European countries, were held in Prague in 1967 and 1968 to discuss "Man and Society in the Scientific-Technological Revolution". Two further symposia took place in Moscow, in 1970, one concerned with scientific, technological, social and economic questions, the other with medico-biological forecasting.

The greatest progress has been made in the forecasting of scientific, technological, economic, demographic and criminological trends which are comparatively easy to express statistically, but the forecasting of trends in ethnic processes, public education, culture and sociology, which are more difficult to define in numerical terms, have tended to lag behind.

In global terms, there is a need for more systematic forecasting on the long-term consequences of the technological revolution, on the easing of international tensions, on the slowdown and ultimate halting of the arms race, and on partial or complete disarmament. The Specialized Agencies of the United Nations, and in particular Unesco, could play a major role in these studies.

The increasing pollution of the biosphere, for example, is closely linked with the dynamics and balances of world fuel and power, raw materials and transport. Even an outline forecast of critical situations that might arise in the future, along with suggestions for meeting them, would be of immense use.

The long-term problem of the world food situation is a major preoccupation of the Food and Agriculture Organization. The "green revolution" and technical advances in the production of synthetic foods open up vast horizons. Yet despite these scientific and technical successes, social conditions in the world are such that two thirds of its people are still undernourished, with one-half actually living under conditions of starvation. Forecasts made with a view to achieving a sufficient food balance could be of capital value in the war against hunger.

A crucial factor in the development of Asian, African and Latin American countries is the problem of finding employment for their exploding populations. To meet this problem, dozens of new agricultural and industrial areas will have to be created on these continents.

In this connexion, the International Labour Organization will certainly need to devote its attention, among other measures, to projects that have been drawn up for a general "reconstruction" of vast areas of the African, South American and Asian continents.

Appropriate use of the potential hydro-electric power of African rivers, particularly the Congo, would provide water for the irrigation of millions of acres of lands which could then become hinterlands for dozens of big industrial centres. The Aswan High Dam, built in the United Arab Republic with aid from the Soviet Union, is a striking example in Africa of a major engineering enterprise designed to transform and develop a national economy.

However, in such far-reaching projects there is an inherent danger that we may unwittingly disturb the balance of nature. But such risks could be reduced to reasonable proportions by systematic forecasts and studies. Considering the social significance of such projects, it would be advisable to begin this research immediately.

No less urgent is the need for forecasts on long-term problems posed by a reconversion of the world economy in the event of a halt being called to the arms race and, beyond this, the prospect of partial or complete disarmament.

It is sometimes suggested that the arms race should be allowed to go on merely to forestall the danger of economic dislocation. It would surely be more sensible to consider this whole question on a scientific basis, by attempting to construct a series of exploratory and normative forecasting models relating to the reconversion of the world economy on a regional and global scale.

The forecasts could cover not only economic aspects, but also prospects for a positive development of international relations, including the progressive easing of international tensions, the completion of de-colonization, the halting of the arms race, the banning of weapons of mass destruction, and complete and general disarmament, with effective control over all these measures exercised by the United Nations and its Specialized Agencies.

Finally, the forecasts could tackle the problems of reorganizing the military-industrial potential of the developed countries as resources for boosting technological and social progress on a global scale.

A programme of this scope and vision would need the services of many research organizations, and a leading role could fall to the scientific bodies of the United Nations, particularly Unesco.

And in this quest for peace and disarmament, the specialists engaged in social forecasting would have a major responsibility to plan for its success. ■

By the beginning of the 21st century, three quarters of the world's population, it is estimated, will be living in urban conglomerations. What life will be like for our children and grandchildren in these cities is anybody's guess, but already futurologists are trying to work out forecasts for the organization and management of these conurbations and the millions living in them. Photos symbolize: left, city built of stacks of punched cards in a world of computers; right, sardine skyscrapers for every Tom, Dick and Harry.

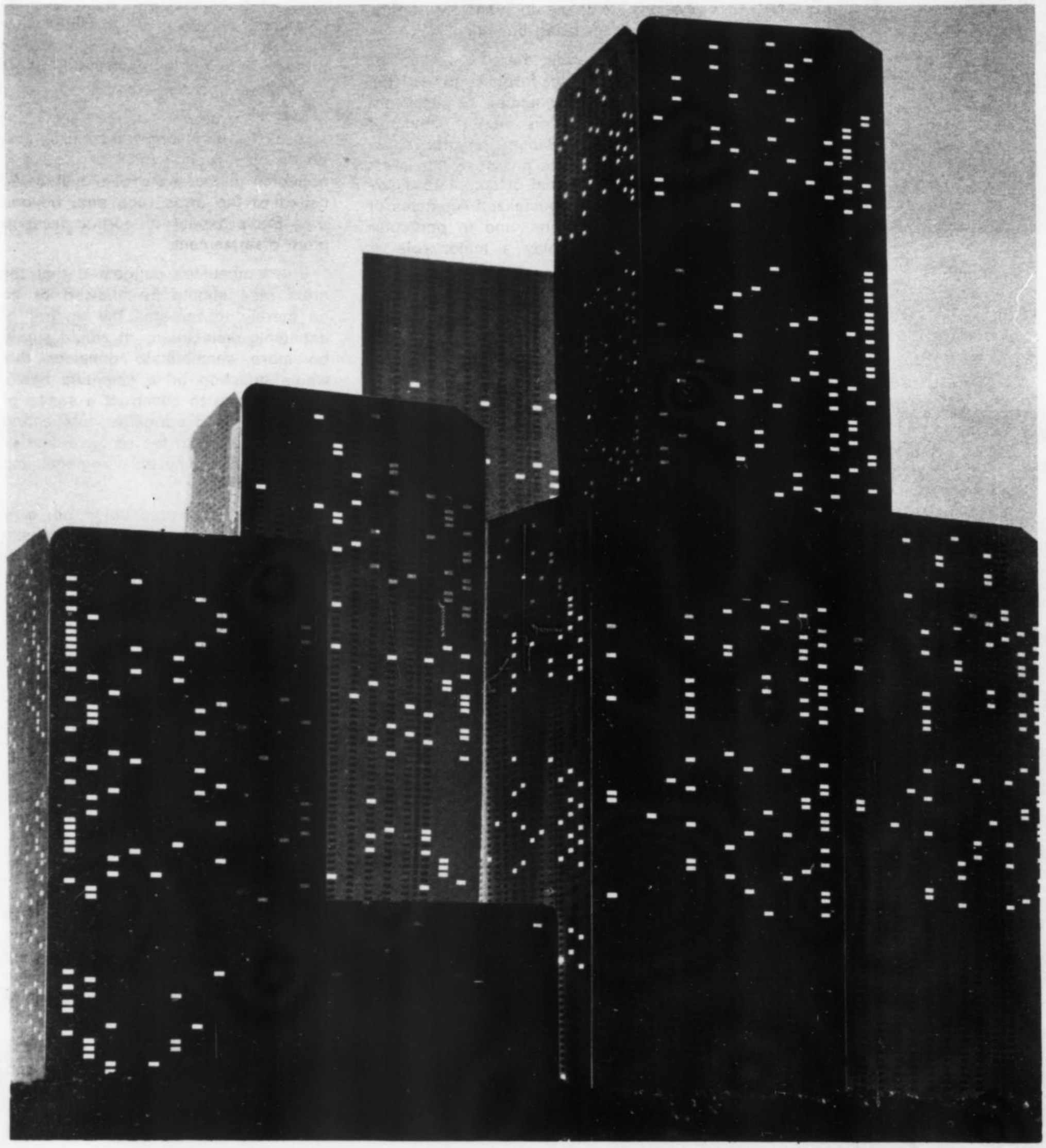


Photo © R. Canessa, Toulon

PONDERING THE IMPONDERABLE

by Pierre Piganiol

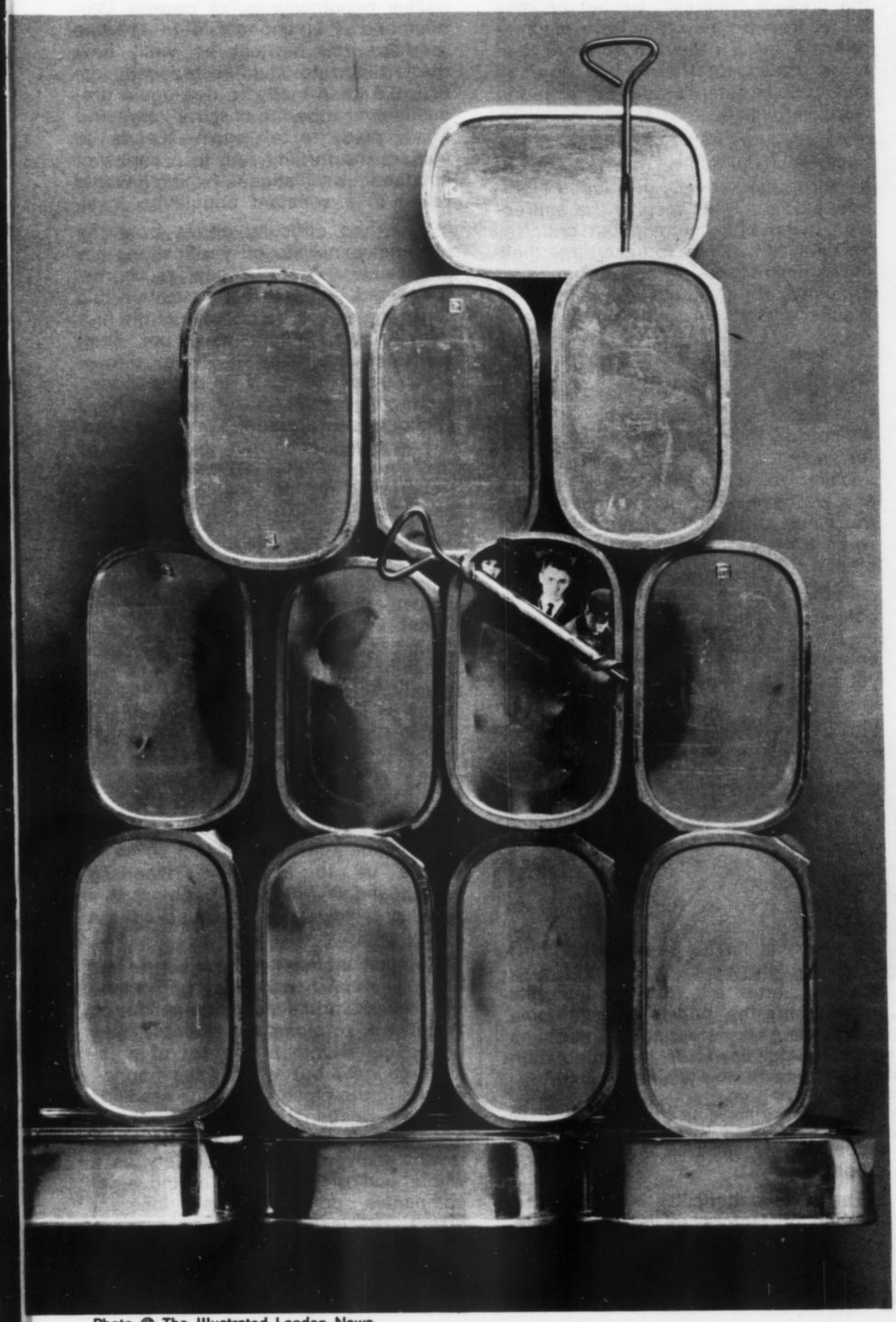


Photo © The Illustrated London News

DECISION-MAKING has always implied looking ahead, that is, looking at the future, or as the late Gaston Berger termed it "a prospective approach". However, it is only in the past 20 years that this prospective approach has been properly defined. (1)

The speed at which modern society is now evolving is a completely new factor the importance of which cannot be underestimated. Our acts today will bear fruit in a world very different from the one in which they were conceived, and even the great conquerors of history who wanted to dominate and change the world rarely imagined that future societies would be very much different from those they lived in.

Gaston Berger expresses his message in a brilliant style which gives a clear picture of his main lines of thought. Society to him is like a ship tossed on a vast ocean which needs pilots to guide it through the rocks, but also requires a prophet to set the course.

Unfortunately, simply to define a prospective or forward-looking attitude is not enough to enable us to select a line of action, and at the time of Berger's death, in 1960, the available method for making such a selection left much to be desired.

Here the futurology approach consisted mainly in pinpointing certain data which were recognized, intuitively or otherwise, as having a determining influence in shaping the future, and carefully studying all the possible implications of any decisions taken.

At about this time there was developed, first in the U.S. and very

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(1) Today the French use the term "prospective" coined by the French philosopher-industrialist Gaston Berger, as a synonym of futurology, with perhaps a slight philosophical overtone that the word futurology does not have in English.

XUM

Computerized happiness, computerized happiness, computerized

soon thereafter all over the world, a technique for choosing a course of action with reference to the very specific needs of those who had to make important decisions in military or industrial matters.

Research carried out in this field led in one instance to the "Relevance Tree" method (see page 14), which stresses the need to formulate clear criteria and to give a weighting (index of relevance) to each element considered in relation to these criteria, some of which may be purely objective, but which, in most cases include concepts relating to quality.

This qualitative weighting is difficult but very necessary since it allows the method to be extended to cover human problems more complex than straightforward technological choices.

Improvement of these methods was, of course, linked with parallel progress in methods of forecasting the most likely future scientific discoveries. In the last few years we have seen an increase in such research and the creation of techniques that range from the systematic classification of the opinions of a panel of experts (the Delphi method, see page 12), to the logical analysis of the patterns of science from which those likely to lead to future discoveries can be deduced.

Despite their obvious limitations, all these methods have proved extremely valuable and, since 1968, there has been a temptation to apply them not only to technological choices but to the evolution of society as a whole.

It was quickly realized, however that the "Relevance Tree" form of reasoning was inadequate for the study of the complexities of the social world. Futurologists have therefore, made use of the "systems" approach which, endowed with a highly sophisticated mathematical technique, had been widely applied in the management of modern industry.

So we have now reached the stage when we can devise the first "social models" that can be handled by computers, thus making it possible to draw the outlines of the dynamic evolution of the world situation in a future which, for some models, extends as far as the year 2050.

We have come round full circle and are returning to Gaston Berger's "prospective attitude" which in the meantime has been enriched by better defined, computer-assisted methods of reasoning.

There is clearly a risk that the method may finally obliterate the objectives. But in my view, we cannot afford to neglect any new methods or techniques or spurn the research aids and tools now available to us. Though the present "models" we set up may be far from perfect, they have much to offer us, even if they do no more than force us accept their more rigorous and precise standards and abandon mere verbalism.

Although I shall be pointing out a number of difficulties that are still inherent in these newly developed methods, I do not wish to give the impression that I have nothing but criticism for them. My aim is to encourage their development and to suggest guiding principles for their use rather than to arouse unjustified suspicion of them.

BUT having said this, I would add that prudence is necessary for many reasons. The first is that social problems are extremely complex and we have still much to learn about the cause and effect relationship between a decision in the field of human affairs and its actual consequences.

I know of no model which is not obliged take into account the changes in population either in a particular country or in the world as a whole; yet as demographers are well aware, it is extremely difficult to isolate the factors that determine the rate of population increase. One can try to link this rate with standards of living, progress in medicine, availability of raw materials, the quality of food or the amount of energy available.

This exercise is very important. If we apply it to the past it confirms the curve followed by the actual growth rate of population up to 1970. But I do not see this as absolute proof of its validity when applied to the future. For this, after all, is what interests us, and here the models indicate some far-reaching transformations such as the slowing down of the population growth rate during the next century.

In brief, the first difficulty lies in our ignorance of the fundamental and indeed highly complex laws of demography.

The second difficulty is due to the number of factors to be taken into account. Here also demography offers an example.

Recent studies relating to a Latin American country revealed in great detail what would happen if the population level was suddenly to become constant.

One might imagine that this situation would solve many economic problems. But this would be an oversimplification. A levelling-off in population would result in remarkably far-reaching fluctuations in the school population, and in the ratio of working to non-working population. This ratio could fluctuate by up to 100 per cent in a series of oscillations over several centuries.

This hypothesis is, of course, Utopian and it is impossible to imagine (perhaps this is just as well) how the fertility rate could be reduced from 6 to 0.6, then made to rise again gradually over a period of thirty years and finally made to fall again—that is, to subject the fertility rate to a series of subdued oscillations which would result in a constant population level.

The third difficulty arises from the fact that experimental verifications are impossible. A model can, of course, be tested against the past, but this suggests implicit acceptance of the fact that transformations have not been sufficiently strong to have thrown doubt upon the structure of the model. I may be wrong, but I do not have confidence in a model simply because it has given a correct description of the events of the last twenty years; I even tend to think that it might have been adjusted to achieve this result.

These models also suppose that various aspects of society can be represented with the help of certain indicators, some quantitative (national income, future yields, etc.), and some qualitative (feelings of happiness, freedom, etc.). These indicators are obviously "global", that is, they include both the many aspects of a particular social situation as well as the whole range of individual human behaviour.

The problem is to know what use these indicators will serve in a period of crisis. We should not forget that these models are established so as to enable us to analyse forthcoming crises, and it would be a pity if this were precisely what they lacked the ability to do.

Perhaps models are subject to the same phenomenon as may be observed in certain mechanical appliances. A network of pipes, for example, may be equipped with a fine set of pressure gauges, but when "hammering" occurs in the pipes the gauge readings bear no relation to real pressure. It may well be wondered whether some recent analyses, both of society as a whole and of a number of industrial companies, do not contain inherent errors precisely because they are using faulty indicators.

Thus, to the material difficulty of processing data whose interactions are

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PIERRE PIGANIOL, *a French physicist and former head of the Délégation Générale à la Recherche Scientifique et Technique, is president of the board of the French National Institute of Agronomic Research, in Paris, and an executive with a French organization dealing with operational research. A leading member of the French National Centre of Scientific Research, he is currently Unesco adviser on science policy to the governments of Senegal and the Lebanon. He has written widely on scientific questions including the future implications of scientific development and other problems of futurology. He is the author of "Pour une Politique Scientifique" (co-author Louis Villecourt), Flammarion (1964); "Maîtriser le Progrès", Laffont (1968); and "Du Nid à la Cité", Dunod (1970).*

often difficult to foresee, another problem is added: a somewhat arbitrary simplification of social phenomena. We may be agreed on the need for simplification for the sake of understanding, but it is much more difficult to accept over-simplified presentations of reality when the time comes to make a decision. Premature over-confidence in the results of what are still experimental methods for exploring the future, and their adoption as a basis for decision-making would be extremely dangerous.

A further difficulty, perhaps even more serious, may be added to those already mentioned. Technological forecasting has developed in a world which has a certain control over innovation in products or processes, and we already have a sketchy, though workable, idea of the innovative process. Nothing comparable exists in the social sciences.

We may conclude this list of difficulties (without, however, completing it) by an important comment: every society has its contradictions; its component sub-systems to borrow an overused mechanistic phrase, are by no means coherent among themselves. The problem is that they mesh with one another just sufficiently so that the tensions created by the underlying contradictions do not exceed acceptable limits.

In the present situation, perhaps we should ask ourselves: are our models and the machines exploring them capable of inventing new structures and resolving existing contradictions?

What I have said could give the impression that I am opposed to the use of these models. I hope I have made it clear that this is not the case. By all means let us use these models but with caution accompanied by a much more scrupulous analysis of those factors in our society that have an influence in determining the future.

Let us identify a few of the most striking, if not the most important, of these factors.

Nowadays, throughout the world, we are witnessing a wave of enthusiasm for higher education. Several major countries have already reached the stage at which about 50 per cent of people of an age to enter higher education in fact do so.

A society in which 50 per cent of citizens have reached this level can in no sense be run in the same way as those in which the training of specialists and administrators is restricted by the limitations of the education system.

There is bound to be an increased desire for responsibility and participation in decision-making. And this desire will emerge in a world in which production units and groups providing

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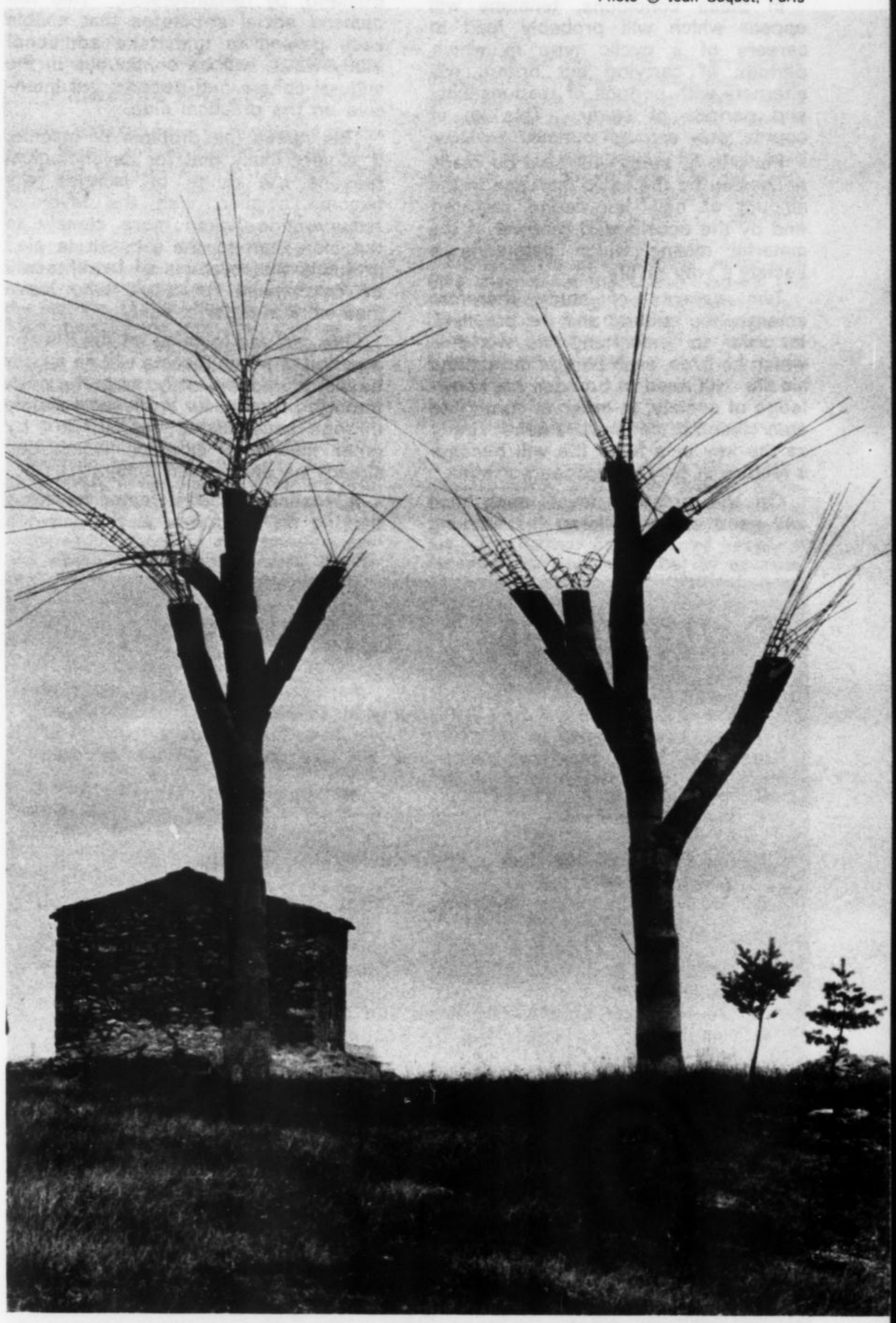
Photo © Jean Suquet, Paris



When the last tree has been felled by the last lumberjack to make way for the latest industrial complex, will nostalgia for the days of autumn leaves and "the darling buds of May" impel us to reforest the land with reinforced concrete conifers and plastic poplars? "From now on", says Pierre Piganiol, "human activities, multiplied by population growth, will have to be studied from the point of view of their interaction with the natural environment".

services will become larger and larger and in which, consequently, the opportunities for responsibility will be fewer than could be desired.

In these conditions, tensions will appear which will probably lead to careers of a cyclic type in which periods of carrying out orders will alternate with periods of responsibility and periods of study. This is, of course, only a rough outline.

Periods of study will also be made necessary by the rapid increase in the amount of new knowledge required and by the accelerated renewal of the material means which determine a society's way of life.

Two aspects of study therefore emerge: the cultural and the practical. In order to understand the world in which he lives, each person throughout his life, will need to broaden his knowledge of society, in order to contribute as a citizen to its improvement. Study as the key to a fuller life will become a feature of fully developed societies.

On the practical level, each man will need either to keep his working knowledge (his working tool which becomes ever more rapidly obsolete) up to date, by re-training, or to acquire new knowledge (another working instrument), by re-conversion. This will demand social structures that enable each person to undertake additional study which will be continuous in the cultural sphere and periodic but intensive on the practical side.

This raises the problem of income. It is very likely that for psychological reasons the range of salaries will become smaller, with the level of remuneration linked more closely to the man than to the job. It is also probable that systems of benefits will be established for those who leave their work in order to study.

One can see looming on the horizon a period in which income will no longer be distributed indirectly, as in the past, through payment for work (or possibly through accumulated capital), but by other means—a situation which can already be partly seen today.

A second essential factor having a bearing on the future is the growing influence of man on his natural environment. Formerly, man was marked off by his capacity for thought from the rest of nature which his presence hardly disturbed and then only in localised areas. Today the situation has changed and our energy requirements, for example, mean that we release into the atmosphere considerable quantities of carbon dioxide which can cause climatic changes.

From now on, human activities, multiplied by population growth, will need to be studied in terms of their repercussions on the natural environment. The forecasting of imbalances or of new states of equilibrium has become essential.

Finally, a third factor: decision-making in a complex world implies extensive knowledge; it requires experts. But how far can these experts take account of public opinion or be controlled by it? Is there not a considerable risk of establishing a more or less esoteric technocracy?

This closes my list of examples. Some ambitious projects attempt to fit every aspect of society into a particular model and, in particular, to deal with the factors I have used as examples by analysing their interactions. What is one to think of this?

The three problems outlined above are clearly very different. The second deals with a concrete problem, a difficult one certainly since it concerns meteorology, but one which, nevertheless, can be expressed in the form of a model. Indeed, it has recently proved possible to make a map of Europe, in connexion with proposed industrial activities in England, showing the sulphur fallout in rain.

The first example deals among other things with the supply and demand ratio for skilled manpower. It is possible to make a model of this; it would be only approximate, but would, nevertheless, be of considerable help to further studies.

The third and last example presents a typical problem of organization and psychology. Nothing is more difficult than to assign numerical values to the "feeling of freedom" or the "sense of responsibility," and it is obvious, for example, that air-line pilots can hardly be selected by universal vote.

From this is clear how complex futurology is and how difficult it is to reduce it to a series of simple formulas or a simple mode of action.

Depending on what approach is taken, the work of the futurologist may be worthwhile and effective (even if certain elements of information are uncertain) or it may be naive and even dangerous (even if the work appears to be based on highly sophisticated reasoning).

When all is said and done, planning the future cannot be reduced to a simple problem of logic (though logic must of course guide all our decisions). Equally important are common sense and questions of ethics. ■

Further reading on futurology

There is such a vast body of writing on futurology in English that we have had to limit this bibliography to a short list of 20 titles. Readers interested in studying more about futurology will find lengthy bibliographies in many of the books listed below.

- **Future Shock,** by Alvin Toffler. Random House, New York, 1970.
- **Inventing the Future,** by Dennis Gabor. Secker and Warburg, London ; Alfred A. Knopf Inc., New York, 1969.
- **The Future of the Future,** by John McHale. George Braziller Inc., New York, 1969.
- **Discovery, Invention, Research,** by Fritz Zwicky. Macmillan, Toronto, 1969.
- **The Language of Forecasting,** François Hetman. (Bilingual English-French dictionary) Coll. Futuribles. Ed. Sédeis, Paris. 1969.
- **Mankind 2000,** Editors : Robert Jungk and Johan Galtung. Universitetsforlaget, Oslo ; Allen and Unwin, London, 1969.
- **Tomorrow is Already Here,** by Robert Jungk. Simon and Schuster, New York, 1954.
- **Futurology,** Int. Social Science Journal, Vol. XXI, No. 4, Unesco, 1969.
- **The Year 2000,** by Herman Kahn and Anthony J. Wiener. MacMillan, London and New York, 1967.
- **Inventing Education for the Future,** Werner Z. Hirsch (ed.). Chandler, San Francisco, 1967.
- **The Art of Conjecture,** by Bertrand de Jouvenel. Basic Books Inc., New York, 1967.
- **Technological Forecasting in Perspective,** by Eric Jantsch. OECD, Paris, 1969.
- **Toward the Year 2000 : Work in Progress.** "Daedalus", Journal of the American Academy of Arts and Sciences, Summer 1967 issue. Cambridge, Mass.
- **History and Futurology,** Ossip K. Flechtheim. Verlag Anton Hain, Fed. Rep. of Germany, 1966.
- **Technology and Man's Future,** by Hasan Ozbekhan. Systems Development Corporation, Santa Monica, Calif., 1966.
- **The World in 1984,** Nigel Calder (ed.). Penguin Books, Baltimore 1965 (2 vol.).
- **Ideas and Integrities,** by R. Buckminster Fuller. Prentice-Hall Inc., Englewood Cliffs, N.J., U.S.A., 1963.
- **Nine Chains to the Moon,** by R. Buckminster Fuller. Southern Illinois University Press, U.S.A., 1963.
- **The Race to the Year 2000,** by Fritz Baade. Doubleday, New York, 1962.
- **The Image of the Future,** Vol. I, by Fred L. Polak. A.W. Sijthoff, Leyden, Netherlands; Oceana Publications, Inc., Dobbs Ferry, N.Y., 1961.

UNESCO NEWSROOM

BOOKSHELF

RECENT UNESCO BOOKS

■ **Students as Links Between Cultures**
A cross cultural survey
Edited by Ingrid Eide
Co-edition Unesco-Universitetsforlaget, Oslo
1970 (£3, $10.00).

■ **Broadcasting from Space**
(Reports and Papers on Mass Communication, No. 60)
1970 (45p, $1.50).

■ **Principles of Cultural Co-operation**
By Sulwyn Lewis
(Reports and Papers on Mass Communication, No. 61)
1971 (30p, $1.00).

■ **Educational Trends in 1970**
An international survey prepared by the International Bureau of Education
1970 (45p, $1.50).

■ **Teachers' Associations**
(International Directories of Education series)
Trilingual: English, French, Spanish
2nd ed. revised, 1970 (£1.05, $3.50).

■ **An Introduction to Lifelong Education**
By Paul Lengrand
1970 (75p, $2.50).

■ **Research for Educational Planning: notes on emergent needs**
By William J. Platt
1970 (60p, $2.00).

■ **The Role of Science and Technology in Economic Development**
(Science Policy Studies and Documents, No. 18)
1970 (£1.20, $4.00).

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■ **La Calligraphie Chinoise : un Art à Quatre Dimensions**
By Leon Long-yien Chang
Club Français du Livre,
8, rue de la Paix, Paris, 1971 (75 F).
(See "Treasures of World Art", page 2).

■ **Unveiling Man's Origins: Ten Decades of Thought about Human Evolution**
By L.S.B. Leakey
and Vanne Morris Goodall
Methuen and Co., Ltd., London, 1969 (£1.60).

Extra funds for Palestine refugee schools

Over $600,000 have been pledged by the Arab States and by Switzerland as additional aid to UNRWA—the U.N. Relief and Works Agency for Palestine Refugees—for the joint UNRWA/Unesco education programme for refugee children. Spain is to contribute $50,000 worth of school equipment. This was stated by Ambassador Mansour Khalid, Sudan's chief representative to the United Nations, reporting in Paris recently on the first part of his round-the-world fund-raising mission as special envoy of Unesco's Director-General, Mr. René Maheu. His mission followed an international appeal on behalf of the refugee schools launched by Mr. Maheu (See "Unesco Courier" March 1971). Extra help is needed because the work of UNRWA, which has cared for the refugees for 20 years, is threatened by a $5 million deficit in its 1971 budget. Ambassador Khalid is also spending several weeks in European countries, the Far East and North and South America.

Unesco anniversary poster competition

To mark Unesco's 25th anniversary this year, the Unesco affiliated International Association of Art is organizing a competition for young artists (aged 15 to 25) to design a poster illustrating the theme "A World Fit to Live In". A first prize of $500 and five additional prizes of $100 will be awarded. Further details from local International Association of Art Offices or Unesco National Commissions in Unesco's member states.

Unesco best known U.N. agency in Japan

Unesco is better known in Japan than any other U.N. Specialized Agency according to a nation-wide public opinion poll on the popularity of the United Nations and its Specialized Agencies and what the Japanese know about their work.

In the poll, carried out last year by the Japanese Prime Minister's Office at the request of the United Nations Association of Japan (UNAJ), persons over the age of 20 were picked at random for questioning.

The results, published recently in a special issue of the UNAJ "Kokuren News" devoted to last year's U.N. 25th anniversary celebrations in Japan, showed that 66 per cent of those questioned knew about Unesco and its work. Next in order of popularity came ILO (51 per cent), followed by the International Monetary Fund (42 per cent), World Bank (38 per cent), UNICEF (36 per cent), Economic Commission for Asia and the Far East (27 per cent) and FAO (14 per cent).

Eighty-six per cent of those polled said they knew about the United Nations and 78 per cent thought it was doing well. Only four per cent found its performances completely negative, while 58 per cent said it needed strengthening.

Five-nation seismic survey

Unesco is to undertake a $4.2 million seismic survey in Bulgaria, Greece, Romania, Turkey and Yugoslavia on behalf of the United Nations Development Programme. The Balkans have suffered heavily in recent years from a number of devastating earthquakes. The 4-year project covers the setting up or modernization of four observatories and 14 smaller stations equipped with seismographs and other instruments. Data obtained will be used to produce maps of seismic risk for designers, engineers and architects responsible for town planning, housing and public works. The UNDP will contribute $700,000 towards the project with the remainder of the cost being borne by the countries concerned.

Flashes...

■ *Nepal has banned tiger shooting and the import and export of tiger skins as a contribution to international efforts to save the animal from extinction.*

■ *Two stone tablets covered with cuneiform inscriptions describing the construction of King Darius' palace at Susa in 522 B.C. have been excavated by a French archaeological team working in Iran.*

■ *Japan recently passed 14 anti-pollution laws including one requiring industries responsible for pollution to pay up to 100 % of the cost of preventative measures.*

■ *The International Development Association is lending Pakistan $25 million for reconstruction in areas stricken by last November's cyclone disaster.*

World social science index

A "World Index of Social Science Institutions" has just been published as a special service of Unesco's quarterly "International Social Science Journal". A bilingual—English/French—index of over 1,000 cards it lists data on social science research units, advanced training and documentation institutions and professional bodies. The Index costs $9, £2.70 ($15, £4.50 with binder). A regular updating service is provided free to subscribers to the "International Social Science Journal" (annual subscription $7, £2.10).

International aid for 4 million refugees

The welfare of an estimated 4 million refugees is today the concern of the United Nations and its Specialized Agencies. To remind the world of this huge and still growing problem, the U.N. Postal Administration last month issued a commemorative stamp (right) on the theme "International Support for Refugees" . It is printed in three denominations (6 and 13 cents and Sw. Fr. 0,50). As agent in France for the U.N. Postal Administration, Unesco's Philatelic Service stocks all U.N. stamps and first day covers currently on sale. For details write to the Unesco Philatelic Service, Unesco, Place de Fontenoy, Paris-7e.

services will become larger and larger and in which, consequently, the opportunities for responsibility will be fewer than could be desired.

In these conditions, tensions will appear which will probably lead to careers of a cyclic type in which periods of carrying out orders will alternate with periods of responsibility and periods of study. This is, of course, only a rough outline.

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From this is clear how complex futurology is and how difficult it is to reduce it to a series of simple formulas or a simple mode of action.

Depending on what approach is taken, the work of the futurologist may be worthwhile and effective (even if certain elements of information are uncertain) or it may be naive and even dangerous (even if the work appears to be based on highly sophisticated reasoning).

When all is said and done, planning the future cannot be reduced to a simple problem of logic (though logic must of course guide all our decisions). Equally important are common sense and questions of ethics. ■

Further reading on futurology

There is such a vast body of writing on futurology in English that we have had to limit this bibliography to a short list of 20 titles. Readers interested in studying more about futurology will find lengthy bibliographies in many of the books listed below.

- **Future Shock,** by Alvin Toffler. Random House, New York, 1970.
- **Inventing the Future,** by Dennis Gabor. Secker and Warburg, London ; Alfred A. Knopf Inc., New York, 1969.
- **The Future of the Future,** by John McHale. George Braziller Inc., New York, 1969.
- **Discovery, Invention, Research,** by Fritz Zwicky. Macmillan, Toronto, 1969.
- **The Language of Forecasting,** François Hetman. (Bilingual English-French dictionary) Coll. Futuribles. Ed. Sédeis, Paris. 1969.
- **Mankind 2000,** Editors : Robert Jungk and Johan Galtung. Universitetsforlaget, Oslo ; Allen and Unwin, London, 1969.
- **Tomorrow is Already Here,** by Robert Jungk. Simon and Schuster, New York, 1954.
- **Futurology,** Int. Social Science Journal, Vol. XXI, No. 4, Unesco, 1969.
- **The Year 2000,** by Herman Kahn and Anthony J. Wiener. MacMillan, London and New York, 1967.
- **Inventing Education for the Future,** Werner Z. Hirsch (ed.). Chandler, San Francisco, 1967.
- **The Art of Conjecture,** by Bertrand de Jouvenel. Basic Books Inc., New York, 1967.
- **Technological Forecasting in Perspective,** by Eric Jantsch. OECD, Paris, 1969.
- **Toward the Year 2000 : Work in Progress.** "Daedalus", Journal of the American Academy of Arts and Sciences, Summer 1967 issue. Cambridge, Mass.
- **History and Futurology,** Ossip K. Flechtheim. Verlag Anton Hain, Fed. Rep. of Germany, 1966.
- **Technology and Man's Future,** by Hasan Ozbekhan. Systems Development Corporation, Santa Monica, Calif., 1966.
- **The World in 1984,** Nigel Calder (ed.). Penguin Books, Baltimore 1965 (2 vol.).
- **Ideas and Integrities,** by R. Buckminster Fuller. Prentice-Hall Inc., Englewood Cliffs, N.J., U.S.A., 1963.
- **Nine Chains to the Moon,** by R. Buckminster Fuller. Southern Illinois University Press, U.S.A., 1963.
- **The Race to the Year 2000,** by Fritz Baade. Doubleday, New York, 1962.
- **The Image of the Future,** Vol. I, by Fred L. Polak. A.W. Sijthoff, Leyden, Netherlands; Oceana Publications, Inc., Dobbs Ferry, N.Y., 1961.

UNESCO NEWSROOM

BOOKSHELF

RECENT UNESCO BOOKS

■ **Students as Links Between Cultures**
A cross cultural survey
Edited by Ingrid Eide
Co-edition Unesco-Universitetsforlaget, Oslo
1970 (£3, $10.00).

■ **Broadcasting from Space**
(Reports and Papers on Mass Communication, No. 60)
1970 (45p, $1.50).

■ **Principles of Cultural Co-operation**
By Sulwyn Lewis
(Reports and Papers on Mass Communication, No. 61)
1971 (30p, $1.00).

■ **Educational Trends in 1970**
An international survey prepared by the International Bureau of Education
1970 (45p, $1.50).

■ **Teachers' Associations**
(International Directories of Education series)
Trilingual: English, French, Spanish
2nd ed. revised, 1970 (£1.05, $3.50).

■ **An Introduction to Lifelong Education**
By Paul Lengrand
1970 (75p, $2.50).

■ **Research for Educational Planning: notes on emergent needs**
By William J. Platt
1970 (60p, $2.00).

■ **The Role of Science and Technology in Economic Development**
(Science Policy Studies and Documents, No. 18)
1970 (£1.20, $4.00).

*

■ **La Calligraphie Chinoise : un Art à Quatre Dimensions**
By Leon Long-yien Chang
Club Français du Livre,
8, rue de la Paix, Paris, 1971 (75 F).
(See "Treasures of World Art", page 2).

■ **Unveiling Man's Origins: Ten Decades of Thought about Human Evolution**
By L.S.B. Leakey
and Vanne Morris Goodall
Methuen and Co., Ltd., London, 1969 (£1.60).

Extra funds for Palestine refugee schools

Over $600,000 have been pledged by the Arab States and by Switzerland as additional aid to UNRWA—the U.N. Relief and Works Agency for Palestine Refugees—for the joint UNRWA/Unesco education programme for refugee children. Spain is to contribute $50,000 worth of school equipment. This was stated by Ambassador Mansour Khalid, Sudan's chief representative to the United Nations, reporting in Paris recently on the first part of his round-the-world fund-raising mission as special envoy of Unesco's Director-General, Mr. René Maheu. His mission followed an international appeal on behalf of the refugee schools launched by Mr. Maheu (See "Unesco Courier" March 1971). Extra help is needed because the work of UNRWA, which has cared for the refugees for 20 years, is threatened by a $5 million deficit in its 1971 budget. Ambassador Khalid is also spending several weeks in European countries, the Far East and North and South America.

Unesco anniversary poster competition

To mark Unesco's 25th anniversary this year, the Unesco affiliated International Association of Art is organizing a competition for young artists (aged 15 to 25) to design a poster illustrating the theme "A World Fit to Live In". A first prize of $500 and five additional prizes of $100 will be awarded. Further details from local International Association of Art Offices or Unesco National Commissions in Unesco's member states.

Unesco best known U.N. agency in Japan

Unesco is better known in Japan than any other U.N. Specialized Agency according to a nation-wide public opinion poll on the popularity of the United Nations and its Specialized Agencies and what the Japanese know about their work.

In the poll, carried out last year by the Japanese Prime Minister's Office at the request of the United Nations Association of Japan (UNAJ), persons over the age of 20 were picked at random for questioning.

The results, published recently in a special issue of the UNAJ "Kokuren News" devoted to last year's U.N. 25th anniversary celebrations in Japan, showed that 66 per cent of those questioned knew about Unesco and its work. Next in order of popularity came ILO (51 per cent), followed by the International Monetary Fund (42 per cent), World Bank (38 per cent), UNICEF (36 per cent), Economic Commission for Asia and the Far East (27 per cent) and FAO (14 per cent).

Eighty-six per cent of those polled said they knew about the United Nations and 78 per cent thought it was doing well. Only four per cent found its performances completely negative, while 58 per cent said it needed strengthening.

Five-nation seismic survey

Unesco is to undertake a $4.2 million seismic survey in Bulgaria, Greece, Romania, Turkey and Yugoslavia on behalf of the United Nations Development Programme. The Balkans have suffered heavily in recent years from a number of devastating earthquakes. The 4-year project covers the setting up or modernization of four observatories and 14 smaller stations equipped with seismographs and other instruments. Data obtained will be used to produce maps of seismic risk for designers, engineers and architects responsible for town planning, housing and public works. The UNDP will contribute $700,000 towards the project with the remainder of the cost being borne by the countries concerned.

Flashes...

■ *Nepal has banned tiger shooting and the import and export of tiger skins as a contribution to international efforts to save the animal from extinction.*

■ *Two stone tablets covered with cuneiform inscriptions describing the construction of King Darius' palace at Susa in 522 B.C. have been excavated by a French archaeological team working in Iran.*

■ *Japan recently passed 14 anti-pollution laws including one requiring industries responsible for pollution to pay up to 100 % of the cost of preventative measures.*

■ *The International Development Association is lending Pakistan $25 million for reconstruction in areas stricken by last November's cyclone disaster.*

World social science index

A "World Index of Social Science Institutions" has just been published as a special service of Unesco's quarterly "International Social Science Journal". A bilingual—English/French—index of over 1,000 cards it lists data on social science research units, advanced training and documentation institutions and professional bodies. The Index costs $9, £2.70 ($15, £4.50 with binder). A regular updating service is provided free to subscribers to the "International Social Science Journal" (annual subscription $7, £2.10).

International aid for 4 million refugees

The welfare of an estimated 4 million refugees is today the concern of the United Nations and its Specialized Agencies. To remind the world of this huge and still growing problem, the U.N. Postal Administration last month issued a commemorative stamp (right) on the theme "International Support for Refugees" . It is printed in three denominations (6 and 13 cents and Sw. Fr. 0,50). As agent in France for the U.N. Postal Administration, Unesco's Philatelic Service stocks all U.N. stamps and first day covers currently on sale. For details write to the Unesco Philatelic Service, Unesco, Place de Fontenoy, Paris-7e.

Letters to the Editor

THE ROOTS OF CULTURE

Sir,

I thought the December 1970 issue of the Courier, on "Carthage must not be destroyed" was magnificent, but the one on "Cultural Policy" (January 1971) I found rather depressing.

Surely, of all institutions, Unesco should be the last to encourage all these nations to try and foster "national pride and dignity" on the basis of some alleged heritage connected with their part of the world. To my mind, an Italian of today has no more connexion with Roman civilization than anybody else, nor for that matter a Tunisian with Carthage.

Everybody, but especially your Jamaican and Kenyan contributors, seems to talk about culture as if it were something mystical brought down upon their people from somewhere. To my lay mind, culture is simply something that grows out of the contributions of individual men and women.

I do not know about African and Asian languages, but I know that someone who is "cultured" or *cultivé* or *kultiviert*, is so not because he was born in England or France or Germany, or is an exponent of that particular culture. It always struck me as absurd and pathetic for people to feel compelled to stick labels of so-called "national origin" to cultural achievements, such as talking about the "German" scientist Albert Einstein, just because the place where he was born happened by chance to be situated in Germany.

Should not Unesco rather emphasize the inter-relation of culture—that European culture anyway seems to have originated in the Middle East, that *Négritude* has made an important impact on Western civilisation, and that instead of the strenuous efforts of some to boost their "national" egos, they should rather start thinking more in terms of universality and humanity.

J. Lettner
Salisbury, Rhodesia

OLD MANGBETU CUSTOM

Sir,

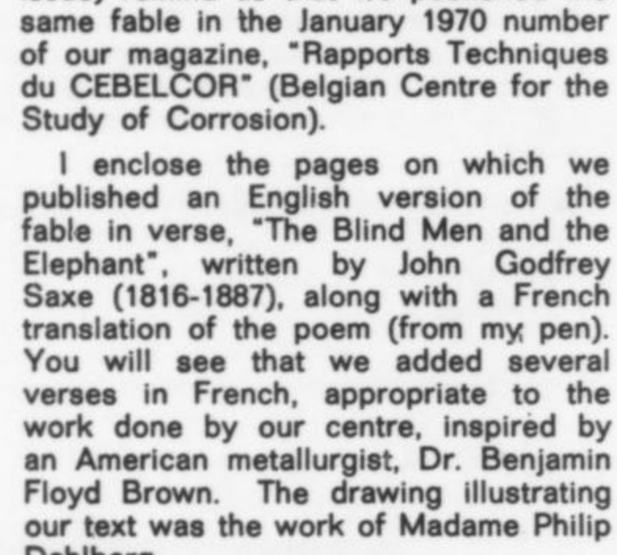
The caption to the photograph of a pottery vessel published in your January 1971 issue (on page 28) describes it as a water jug "made by an African craftsman of Mangbetu".

It should be pointed out that "Mangbetu" properly describes not a place, but a Nilotic people from the region of Isiro in the North of the Democratic Republic of the Congo.

It is interesting to note that until some thirty years ago it was a Mangbetu custom to deform the shape of their children's skulls by binding the head tightly with cords immediately after birth. As the head grew it assumed a kind of sugarloaf form and the eyes took on a somewhat slit-like appearance.

Their distinctive hair style and the elongated shape of their heads gave the Mangbetu the characteristic appearance that is clearly recalled in the sculptured head on the vessel you show.

J.J. Deheyn
Paris, France



Drawing by Mme Philip Dahlberg, Brussels

BLIND MAN'S BLUFF

Sir,

The photo and the text recounting the well known Indian fable of the blind men and the elephant ("Blind Man's Bluff", page 16 of your January 1971 issue) remind us that we published the same fable in the January 1970 number of our magazine, "Rapports Techniques du CEBELCOR" (Belgian Centre for the Study of Corrosion).

I enclose the pages on which we published an English version of the fable in verse, "The Blind Men and the Elephant", written by John Godfrey Saxe (1816-1887), along with a French translation of the poem (from my pen). You will see that we added several verses in French, appropriate to the work done by our centre, inspired by an American metallurgist, Dr. Benjamin Floyd Brown. The drawing illustrating our text was the work of Madame Philip Dahlberg.

Marcel Pourbaix
Director, Belgian Centre
for the Study of Corrosion, Brussels

We reproduce, right, the poem by John Godfrey Saxe together with our rendering of the verses in French added by the Brussels Centre—Editor.

THE BLIND MEN AND THE ELEPHANT

By John Godfrey Saxe

It was six men of Hindostan,
To learning much inclined,
Who went to see the elephant
(Though all of them were blind);
That each by observation
Might satisfy his mind.

The first approached the elephant,
And happening to fall
Against his broad and sturdy side,
At once began to bawl,
"Bless me, it seems the elephant
Is very like a wall."

The second, feeling of his tusk
Cried, "Ho! what have we here
So very round and smooth and sharp?
To me 'tis mighty clear
This wonder of an elephant
Is very like a spear."

The third approached the animal
And happening to take
The squirming trunk within his hands
Then boldly up and spake;
"I see", quoth he, "the elephant
Is very like a snake".

The fourth stretched out his eager [hand
And felt about the knee,
"What most this mighty beast is like
Is mighty plain", quoth he;
"'Tis clear enough the elephant
Is very like a tree."

The fifth who chanced to touch the [ear
Said, "Even the blindest man
Can tell what this resembles most;
Deny the fact who can,
This marvel of an elephant
Is very like a fan."

The sixth no sooner had begun
About the beast to grope
Than, seizing on the swinging tail
That fell within his scope,
"I see", cried he, "the elephant
Is very like a rope."

And so these men of Hindostan
Disputed loud and long,
Each of his own opinion
Exceeding stiff and strong,
Though each was partly in the right,
And all were in the wrong!

Additional verses inspired by some reflections on corrosion research by Dr. Benjamin Floyd Brown.

To readers, friends, researchers
Seeking stress corrosion's key,
This humble fable nurtures
A moral all can see.

Microstructures, dislocations,
Mechanics of break and strain,
Physi-chemical relations
And chemistry pure and plain,

Corrosive interactions,
All electro-chemistry,
Films that interdict reactions,
Cathode, anode alchemy,

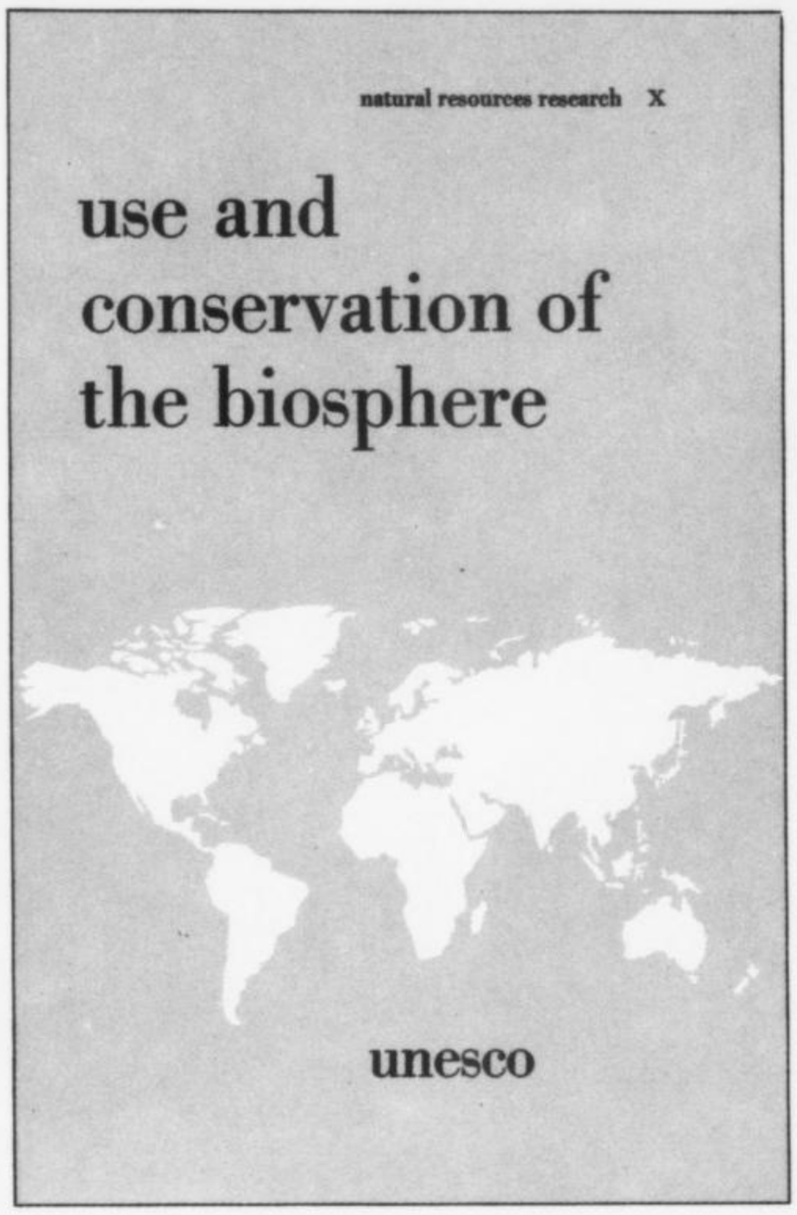
As the wise Floyd Brown related,
"Here's the whole anatomy
Of stress corrosion stated
With clear simplicity.

"But a perfect comprehension
Of the problem we can't wrest
From each separate point I mention
Isolated from the rest.

"We must give consideration
To the problem as a whole;
Overall examination
Is the way to reach our goal."

Imp. GEORGES LANG, PARIS. IMPRIMÉ EN FRANCE. — Dépôt légal. 1er trimestre 1971 - C 1

A major Unesco study



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An outstanding study of man's exploitation of nature and his environment and its effects on the delicate balance of the Biosphere—the thin layer of air, water and land on our planet where life exists. Presents views and findings of scientists at the first world conference on Man and the Biosphere, held at Unesco, Paris, in September 1968. Poses one of the most crucial questions of our time: 'Can we keep our planet habitable?'

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- ***The increasing pollution of air and water***
- ***Deforestation and loss of soil fertility***
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★

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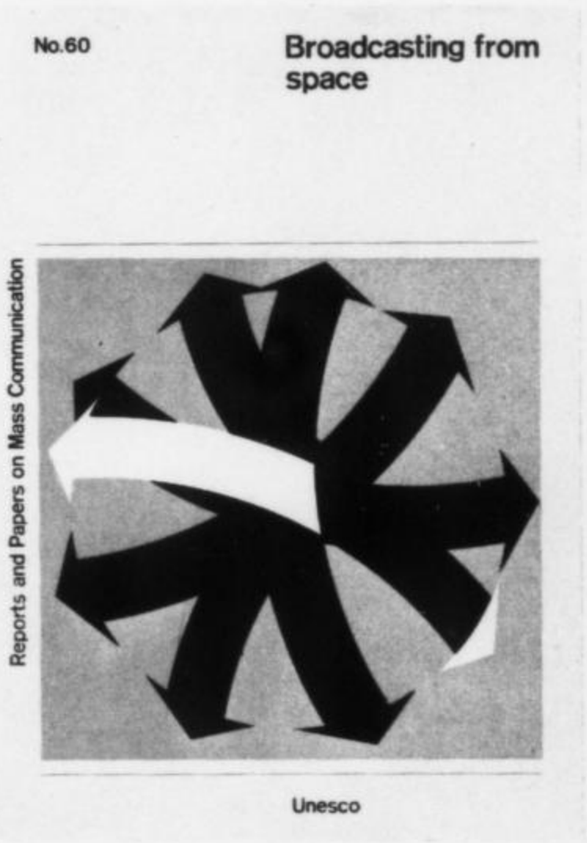

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THROUGH THE LOOKING-GLASS

Photo Siemens

The wide-eyed glance of the young woman in our photo is reflected, not in a mirror, but in a "memory plate" from a Siemens computer. Its shiny, nickel-iron surface, composed of 3,150 cells, can record and recall up to 10 million units of information per second. After an initial obsession with technological forecasting, futurology seems to be turning more and more to a scrutiny of man's social future. Dare we hope that the machine will be reduced to its proper proportions—a mute reflection of human genius?

XUM